

1102 19550  
Literature

ARNOLD'S SCHOOL SERIES.

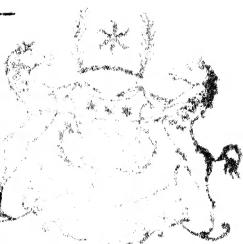
G.O.

ARNOLD'S  
OBJECT READERS

---

BOOK III.

---



EO9499

LONDON  
EDWARD ARNOLD  
41 & 43 MADDOX STREET, BOND STREET, W.  
[All rights reserved]

## **ARNOLD'S OBJECT READERS.**

**BEAUTIFULLY ILLUSTRATED**

BY

**FANNY MOODIE, CHARLES WHYMPER, and H. G. MOON.**

**With numerous finely-coloured Plates.**

A Series of Reading Books adapted to the requirements of the Board of Education, containing simple lessons, written in childlike language, on objects familiar to children, and the ordinary phenomena of common life.

**Book I.—Animals and Common Things. 10d.**

**Book II.—Animals and Common Things. 1s.**

**Book III.—Plants, Natural Phenomena, and Important Industries. 1s. 3d.**

### **ARNOLD'S OBJECT LESSONS.**

The Teacher's Handbooks to Arnold's Object Readers.

Books I., II., III. 1s. each.

### **THE G.S. OBJECT READERS.**

Object Lessons in Geography and Elementary Science for Junior Classes. Book I., 10d. Book II., 1s. Book III., 1s. 3d.

# CONTENTS.

	PAGE		PAGE
WHAT IS A PLANT? - - -	7	THE LEAVES OF PLANTS - - -	92
THE GREAT WORKER - - -	11	STRIKE A LIGHT - - -	98
WHAT IS AIR? - - -	17	HOW WATER TURNS INTO	
THE PARTS OF A PLANT - -	21	VAPOUR - - -	103
HOW KNIVES ARE MADE - -	25	NOTES ON THE COLOURED	
THE AIR WE BREATHE - - -	30	PICTURES - - -	106
NOTES ON THE COLOURED		FLOWERS AND BLOSSOMS - -	109
PICTURES - - -	34	HOW COAL-GAS IS MADE - -	114
HOW PLANTS GROW FROM		WHY A BALLOON ASCENDS - -	119
SEEDS - - -	37	NOTES ON THE COLOURED	
ALL ABOUT BUTTONS - - -	42	PICTURES - - -	127
THE AIR PLANTS BREATHE -	44	FRUITS AND SEEDS - - -	128
THE ROOTS OF PLANTS - - -	47	MORE FRUITS AND SEEDS - -	132
NOTES ON THE COLOURED		DRY FRUITS - - -	136
PICTURES - - -	55	NOTES ON THE COLOURED	
HOW PINS ARE MADE - - -	56	PICTURES - - -	142
WHAT IS WATER? - - -	59	THE LIFEBOAT - - -	145
THE STEMS OF PLANTS - - -	62	THE GOLDEN FLEECE - - -	149
CURIOUS STEMS - - -	65	HOW VAPOUR TURNS INTO	
NOTES ON THE COLOURED		WATER - - -	151
PICTURES - - -	70	PLANTS WHICH POISON - - -	155
HOW NEEDLES ARE MADE - -	73	THE LIGHTHOUSE - - -	160
AIR AND WATER COMPARED -	77	KING COTTON - - -	164
HOW CROCKERY IS MADE - -	82	WHAT IS DEW? - - -	169
AIR CURRENTS - - -	87	AN OCEAN STEAMER - - -	172
NOTES ON THE COLOURED		EXERCISES ON THE LESSONS -	177
PICTURES - - -	91		

## COLOURED PLATES.

	PAGE
I. ROOTS—(1) Celery, (2) Onion (3) Strawberry, (4) Turnip, (5) Carrot - - -	2
II. LEAVES—(1) Box, (2) Beech, (3) Elm, (4) Fern, (5) Ivy, (6) Holly, (7) Oak - - -	35
III. WILD FLOWERS—(1) Primrose, (2) Violet, (3) Honeysuckle, (4) Buttercup, (5) Water Lily, (6) Daisy - - -	54
IV. GARDEN FLOWERS—(1) Dahlia, (2) Tulips, (3) Pelargonium, (4) Carnation, (5) Rose - - -	71
V. FRUITS—(1) Cherry, (2) Plum, (3) Apple, (4) Pear, (5) Lemon, (6) Orange - - -	90
VI. FRUITS—(1) Grape, (2) Gooseberry, (3) Raspberry, (4) Strawberry, (5) Currants, (6) Blackberry - - -	107
VII. INDUSTRIAL PLANTS—(1) Wheat, (2) Flax, (3) Barley (4) Cotton, (5) Oats, (6) Hops - - -	126
VIII. POISONOUS PLANTS—(1) Foxglove, (2) Monkshood, (3) Meadow Saffron, (4) Deadly Nightshade, (5) Thornapple, (6) Yew, (7) Henbane, (8) Bittersweet - - -	148

## ' N O T E .

---

THE LESSONS on Objects are arranged so that the chief points may be brought clearly before the children, and used as exercises for memory and repetition. The Notes at the head of each Lesson, and the Summaries at the end of the book, will also serve for Composition Exercises.

# ARNOLD'S OBJECT READER

## BOOK III.

LEE JUNG BAHN

### I. WHAT IS A PLANT?

#### Plants—

Are living things.  
Grow out of the  
ground.  
Grow in water.

#### Plants—

Are mostly fixed.  
Have no motion,  
and no feeling  
like animals.

#### Kinds of plants—

Trees and shrubs.  
Grasses and herbs.  
Mosses and ferns.  
Vegetables.

#### 1. What is a plant?

Stop a moment. Do not answer this question without thinking. It seems so easy, that almost every one is ready with an answer, and yet I could not ask you a much harder question.

2. One day I asked a number of children, who, like you, see plants every day, and who think that they know, what a plant is. So they began to answer at once.

3. A boy said: "A plant is a living thing."

"So is a monkey," I replied; "but a monkey is not a plant."

The answer was right as far as it went, but as it would do either for an animal or a plant, it

was not complete. Every animal is a living thing, and every plant is a living thing; but only some living things are animals, and only some living things are plants.

4. A girl said : " A plant is a living thing, which grows."

But this answer, like the last, includes both animals and plants. They both live, and they both grow.

5. Another child said : " A plant is a living thing, which grows, and is fixed to one place."

But even this answer is not complete, as it will do for some animals, and will not do for every kind of plants.

6. There are some animals like the sponge, which are fixed as fast to one spot as a tree is rooted in the ground. And there are plants which grow in the water, and float about, without ever fixing their roots anywhere.

7. The next answer was : " A plant is a living thing that has no feeling."

Now, this answer does not include animals, and, in a way, it is correct about all plants. Yet there are plants which have a kind of feeling. The leaves of some plants close if anything touches them, and the leaves of other plants catch the flies which light on them (see page 98).

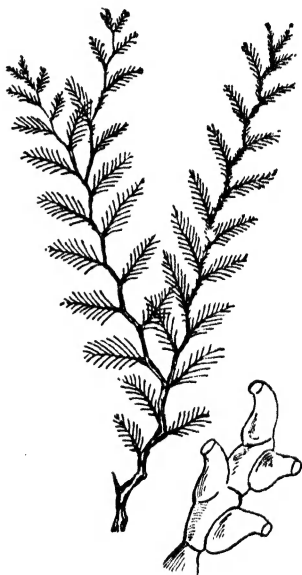
8. You see, therefore, that it is not an easy

thing to frame a complete answer to the question :  
"What is a plant?"

The reason is, that some plants and some animals are very much alike. Here are two



A SEA PLANT.



A SEA ANIMAL (POLYPES).

pictures, the one of an animal, and the other of a plant. They are so much alike in appearance that we can scarcely tell the one from the other.

9. The animals and plants which we know best are quite easy to tell. No one could mistake an

oak tree or a rose bush for an animal, or take a horse or a monkey for a plant.

10. But I have not yet told you all the answers that were given. Here are some of them :

“ A plant is a tree.”

“ A cabbage.”

“ Grass.”

“ A thing with roots.”

“ A thing with branches and leaves.”

11. Now, these are the answers which children give when they do not stop to think, and which do not tell anything. They do not say what a plant is, but give examples of plant life.

12. So we must make an answer which does not include anything but plants, and yet includes all forms of plants. We must think of the stately oak, the clinging ivy, the bushy currant, the creeping strawberry, the leafy cabbage, the rooty carrot, the beautiful rose, and the stinging nettle —of plants which grow on land and in water, in the garden, the field, and the forest.

13. What is a plant ?

A plant is a living thing, which grows, which has no feeling or motion like an animal, being mostly fixed or rooted in one spot. Plants are passive and receive, animals are active and do.

## 2. THE GREAT WORKER.

Iron is—	Iron—	Forms of Iron—
A mineral.	Is hard.	Iron ore.
A metal.	Is heavy.	Cast iron.
Dug out of mines.	Is strong.	Wrought iron.
Found with coal.	Will melt.	Steel.

1. Gold is sometimes spoken of as “the king of metals.” And, while we are willing to place it above others, on account of its value and beauty, we claim for iron that it is far more useful than gold, and is well worthy of being called “the great worker.”

2. Iron is so plentiful in this country that we do not value it as we ought. We could do without gold, but we must have iron. We must have it to make our machines, our tools, our engines, our ships, our weapons of war, and the pans and kettles we use in our houses.

3. Iron ore, that is, iron mixed with other substances, is found in all the great coalfields—in the north, in the middle, and in the west of England, and in South Wales.

4. Iron ore is first roasted. It is broken up into small lumps and mixed with coal, piled up into heaps, and the whole set on fire. This is also done in kilns. Then it is smelted in a blast furnace, heated with coke or coal.

5. The furnace is a large, iron-cased brick tower, from forty to a hundred feet high. It is closed at the bottom, and the air needed to keep the fire burning is blown through pipes. This is called the blast.

6. The furnace is filled to the top with layers of coal or coke, iron ore, and limestone, the one above the other. The limestone is put in to remove the earthy matter from the iron. These substances combine, and, being lighter than the metal, float on the top of the melted iron.

7. The whole is then fired, and the work of smelting begins. Day and night, all the year round, the furnace blazes away. Unless there is a need for repairs, or no demand for iron, the fire is never allowed to go out. If this should happen, it would cost about five hundred pounds to put the furnace in order, before the work of blasting could be resumed.

8. So much fuel is needed that, to make the most use of it, none of the heat is wasted. Formerly, the gases, which formed in the furnace, were allowed to escape from the top, and were therefore lost. Now they are carefully stored, and employed to drive the engine which creates the blast that is forced through the pipes.

9. Let us take a peep into the furnace. The great heat and the fierce glare of the fiery mass



A BLAST FURNACE.

prevent us from approaching too near. But by the aid of cleverly made tubes, with coloured glasses, we are able to watch the burning metal fall to the bottom of the furnace, while the waste substances, drawn together by the limestone, rise to the top.

10. The tapping of a blast furnace by night is a sight never to be forgotten. The casting-yard is a piece of ground covered with sand. Before the tapping takes place, this yard is prepared. Small channels or moulds are made

in the sand, and are called by the workmen the "sow and her pigs."

11. At the bottom of the furnace there is a hole stopped up with clay. This clay is knocked out when the tapping takes place, and out pours the white-hot liquid iron. Slowly the molten mass flows into the channels in the sand, and at the same time throws off thousands of bright sparks.

12. Men with long poles direct its movements. At length all the channels or moulds are full. The hole in the furnace is again stopped with clay, and filled as before, so that the work of smelting may go on.

13. The metal which has been run off is left to cool, and is called cast iron, or, from the name of the moulds, pig iron. Each separate mould is called a pig.

14. Cast iron is only used for articles that are moulded, such as lamp-posts, pillars, railings, grates, and gas and water pipes. Though able to bear great weights, cast iron is very brittle. It will break before it will bend.

15. To make cast iron into wrought iron, the pigs or bars are put into a furnace with a low, arched roof. The fire is lighted, and the low roof draws the flames down on the metal, which soon begins to melt. It is then stirred about by a man

NAWAB SALAR JUNG BAHADUR.



TAPPING A FURNACE.

(From the "*English Illustrated Magazine*.")

called a puddler with a long iron rod, so that air can get into it.

16. The metal is now like dough, and the puddler works his rod very quickly, and gathers it together in lumps. At a given signal, the furnace door is opened, and another man seizes one of the glowing lumps with a pair of tongs, and carries it to be hammered.

17. This is usually done by steam hammers, which fall on it with a crushing weight. It is afterwards cut into slips, which are bound together with iron wire. By this time it has so cooled down that it must be again heated before it can be further worked. This is done, and again it is hammered and beaten into a solid piece.

18. It is now called wrought iron, and is ready for rolling. In this state it can be made into iron plates for ships and steam boilers, anchor chains, horse shoes, shovels, and various tools. Any article made of wrought iron may be mended by simply heating the broken parts red hot, and hammering them together. This is called welding.

19. To make iron into steel it is put into another furnace, and made very hot. Powerful jets of air are forced upwards through the molten mass. Then it is allowed to cool slowly. The process takes about three weeks. One week is spent in gradually raising the furnace to the

required heat, one in keeping up the heat, and one in gradually cooling it down.

20. A bar of iron is worth about twenty shillings. Made into horse shoes, it is worth twice as much. Made into needles, it is worth about seventy pounds. Made into penknife blades, it is worth six hundred pounds, and made into springs for watches, it is worth fifty thousand pounds. This shows how much labour adds to the value of raw materials.

**Learn**—LESSON 2, *page 177.*

### 3. WHAT IS AIR?

<b>Air is—</b>	<b>Air is—</b>	<b>Air—</b>	<b>Air is—</b>
A substance.	Light.	Occupies space.	Oxygen
A gas.	Transparent.	Presses every way.	and
A fluid.	Invisible.	Cannot be grasped.	Nitrogen.

1. Air is one of the most common things in the world, and it is also one of the things that we cannot do without. It is so common that it is always present with us wherever we are. In our houses, and out of doors, day and night, sleeping and waking, we are always surrounded by air. We cannot live without it. If we were in any

way shut off from the air, we should die in a very short time.

2. Air is now present in this room, and it fills up every part that we call "empty." We do not think of air as we think of desks, and forms, and books, and slates, because we cannot see it, or grasp it in our hands, and also because it is so easily pushed aside. Yet it is just as really filling up space in the room as the things are, which we can see and lay hold of.

3. Now, though we cannot see air, we can often feel it, and we sometimes see what it does. When the air is still, and we are still, we do not feel it; but when the air moves about us, or when we move quickly through the air, we can feel it.

4. If we wave our hands to and fro, we shall at once set the air in motion, and we shall feel it pass through our fingers. If we fan ourselves with a book or a slate, we shall feel the air strike against our faces.

5. Sometimes, when there are papers on a desk or a table, and a person goes past very quickly, the papers are swept off on to the floor, and yet no one has touched them. The air, set in motion by the moving person, has moved the papers, and shown that air is present.

6. Then, again, we often feel the air pass into a room through an open door or window, and

sometimes it comes in under the door or through the woodwork of badly fitting windows. This movement of the air we call a draught.

7. When the air moves out of doors, we call it wind, and we sometimes speak of wind as a breeze. But, both "wind" and "breeze" are only names given to air in motion. Sometimes air moves very fast, and blows so very hard that we can scarcely walk against it.

8. When we read the story of a great storm on land or water, during which trees are torn up by the roots, chimneys blown down, and ships wrecked, we do not think that the powerful wind, which can do so much harm, is nothing but the air, which is so gentle when it is still, and so transparent that we cannot see it.

9. Now, to understand what air is, we must remember that there are certain things in the world which are produced by nature. These things are of three kinds--some are solid like iron, some are liquid like water, and some are gases like air.

10. We can see as well as feel solids and liquids, but we cannot see gases. A gas is a substance made up of particles--that is, very small parts, which do not stick together, but are always trying to push each other away.

11. This causes them to rush into what are called

“empty” spaces. We cannot make a hole anywhere, in a wall or in the ground, but the moment we remove the stones or the soil the air will rush in. The places we ourselves fill in a room do not contain air, but if we move to the right or to the left, air will at once take our places. Because air flows in a body it is called a fluid.

12. If we put a pint of water into a quart bottle, the water will at once settle down, and fill only the same space that it occupied in the smaller bottle. But if the air contained in a pint bottle is put into a quart bottle, it will spread out and fill all the space.

13. We therefore see that air is a gas, because it is made up of particles, which do not stick together. It flows in every direction where there is space for it to go, and it changes both its size and its shape to suit the space it fills.

14. Now, among the gases found in nature there are two; one is called oxygen gas and the other is called nitrogen gas. These two gases mix together of themselves and form another gas, which we call air.

15. We need both of these gases, for with one of them only we could not live at all, and with the other only we should not live very long. Nitrogen gas alone will not support life, and oxygen gas alone would cause us to live too fast,

and our bodies would soon be used up. We should be just like a fire which burns away too quickly, and then dies out, because there is no fuel of any kind left to burn.

16. Oxygen gas and nitrogen gas are not mixed in equal quantities—that is, half and half—to form air. Nature mixes together just enough of each kind to make the air safe and healthful to breathe. In pure air there is about four parts of nitrogen to one part of oxygen.

**Learn**—LESSON 3, *page* 178.

#### 4. THE PARTS OF A PLANT.

**Plants have—**

Roots,	} Organs of life.
Stems,	
Leaves,	

**Plants have—**

Flowers,	} Produce new plants.
Fruits,	
Seeds,	

1. If we walk through a garden or along a country road, we shall see that plants are not all alike. We have only to compare a large tree and the tiny daisy at its foot; the climbing pea and the sturdy holly; the leafy cabbage and the slender grass, to see how much plants differ from one another.

2. But though plants are often unlike in ap-

pearance, most of them consist of three parts, called the root, the stem, and the leaves. Each part has its own work to do, and these parts are all that a plant needs for its own growth.

3. We must always remember that plants are as much living things as we are. And, just as we depend for health and strength and growth on the proper working of our hearts and lungs and stomachs and other organs, so do plants depend on their roots, stems, and leaves. They are the organs of the plants. That word "organ" means something—a part of a body or a plant—which has a special kind of work to do.

4. While the organs of a plant do their work properly, the leaves are green, the plant is healthy, and it continues to grow. If the organs are hindered in their work, the plant suffers. It will not grow as it should, and it may even wither away and die.

5. The root of a plant is that part which is mostly under the ground. It grows downwards, and spreads out under the surface, and obtains nourishment from the soil. It also serves in most instances to fix the plant in one place.

6. The stem of a plant is that part which grows upwards from the root. It is sometimes green, soft, and juicy, and sometimes brown, hard, and woody. The stem of a tree is called its trunk.

Some stems send out smaller stems, called branches, which spread out on every side. Through the stems flow juices, called sap, from the root to the upper parts

7. The leaves grow out of the stem and its branches. They are generally green flat blades, and they are of many different forms. No matter of what shape they are, their object or work is the same, and that is to take in through tiny pores part of the plant's food from the air.

8. Now, though plants need these three parts—the root, the stem, and the leaves—for their own life and growth, the most of them also produce flowers, fruit, and seeds. But these parts do not help to feed the plant. Their work is to provide for the growth of new plants.

9. The flowers, also called bloom or blossoms, appear when the plant has reached a certain



A COMPLETE PLANT.

growth. They vary greatly in different plants, in form, in size, and in colour. They are so very beautiful, that we often grow plants for the sake of their flowers only.

10. Still, we must not forget that the sole object of the flowers on the plants is to form the fruit or seeds. The fruit of a plant is that part which contains and protects the seed while it grows and ripens. Though, as a rule, we only give the name to those seed vessels or seed holders which are good for food—such as the apple, the nut, the grape, and the melon—the pods of peas and beans, the acorn, and grains of all kinds are really the fruits of the plants on which they grow.

11. The seed is the fruit, or that part of the fruit which has the power to change into a new plant. This is the most wonderful part of plant life. Plants bear seed, from which new plants of the same kind will grow, and in this way nature keeps up the stock of plants year after year, and from age to age. Gardeners also increase many plants in other ways as well as by seeds.



SHEFFIELD SMOKE.

(From the "*English Illustrated Magazine*.")

## 5. HOW KNIVES ARE MADE

<b>Knives are—</b>	<b>Blades are—</b>	<b>Handles are</b>
Called cutlery.	Steel.	Tempered.
Made by cutlers.	Forged.	Ground.
Made at Sheffield.	Hardened.	Polished.
		Ivory.
		Horn.
		Bone.

1. For hundreds of years the town of Sheffield has been famous for making weapons and edge tools. The heads of the arrows which fell so thick and fast in bygone times, and which no

doubt gave victory to the English in many a battle, were made at this busy town in the West Riding of Yorkshire.

2. The Sheffield cutler is one of the finest workmen in the world. Each man has a set part of the work to do. One man makes table knives, another scissors, and another razors. He who forges the blades does not grind them, and he who does the grinding does not fix the handles.

3. In no other trade has machinery made as few changes as in cutlery. Every blade, that is worth anything, is forged on the anvil and beaten out of the steel rod by hand, and then ground on a stone, over which the workman bends low and uses all his skill.

4. On entering a cutler's shop we are struck by the absence of those wonderful machines, which now-a-days we find in manufactures of all kinds. Here, however, we see only forges and curiously-shaped anvils and troughs full of water. A rod of steel and a hammer seem to be the cutler's stock-in-trade. With these he will fashion a knife blade perfect in shape, as hard as flint, and that will also bend like a cane.

5. The most interesting part of the work in the making of cutlery is the forging. With a pair of pincers the forger seizes a red-hot bar of steel, lifts it out of the forge, and, after a few rapid and



FORGING KNIFE BLADES.

(From the "English Illustrated Magazine.")

well-directed blows of his hammer, the form of a knife blade is produced.

6. A small strip of wrought iron is next welded to the base of the blade. This is called the "bolster," that is, the shoulder-cap, which meets

the handle, and the "tang," or tail, which passes down the middle of the haft. The blade is then again made hot, hammered straight, and stamped with the maker's name.

7. The next stages through which the knife blade passes are those of hardening and tempering. Hardening changes the blade from being a soft strip like lead, to be as hard and brittle as glass. This is done by heating the blade to a dull red heat and then plunging it into cold water.

8. This seems a simple thing to do, but it is not so. The whole depends upon two things, when and how; the blade must be put into the water in the right manner and at the right time.

9. When the blade is taken out of the water it has still to be tempered. This consists in passing it over the fire till it is elastic, when it is again plunged into cold water. After tempering, the blade passes on to the grinder, who smooths it a little on the grindstone. Then it is sent back to the smithy to be made quite straight, after which it is again ground.

10. Knife handles are a separate branch of industry. Ivory is used for the handles of the best table-knives, though some are made of mother-of-pearl, tortoiseshell, and even gold and silver. Cheap knives have handles made from imitation ivory, stag horn, cow horn, and wood.

11. The handles are bored, and into the hole the tang is inserted. It is kept in its place by rivets, which pass through both the tang and the handle. Some of the best knives have what are



MAKING KNIFE HANDLES.

(From the "*English Illustrated Magazine*.")

called balance handles. The handles are heavier than the blade, so that when they are placed on the table the blade does not touch the cloth.

## 6. THE AIR WE BREATHE.

We breathe	Pure air is	Impure air is	We breathe
Air.	Nitrogen	Nitrogen.	Oxygen in,
To live.	and	Oxygen.	and carbonic
Always.	Oxygen.	Carbonic acid.	acid out.

1. We cannot breathe without air, therefore we cannot live without air. That is why we never stop breathing, both when we are awake and when we are asleep. No matter how still a person may be, we know that if he is breathing he is alive.

2. Air, as we have already learned, is a kind of gas, made up of two other gases. These are oxygen gas and nitrogen gas. Oxygen is the gas which supports life, and therefore we must take care to have a proper supply of it. Good air contains a certain quantity of oxygen, and only good air is fit to breathe.

3. But how are we to know when the air is not good, and what must we do to change it when it is bad? If the air is not changed, we are forced to breathe it whether it is good or bad.

4. That is quite true. However bad the air round about us may be, we have no choice but to breathe it. Therefore, we ought to use all the means in our power to get rid of bad air, and keep up a proper supply of good air.

5. But, first of all, we must find out what makes the air bad or impure. Nature mixes the air so that it shall contain the right quantity of oxygen for our needs; how, then, is it made impure?

6. In a very simple way. We take the air provided for us and use it, and in the act of using it we make it impure. Nature mixes two gases, and we add a third.

7. We are doing this every moment of our lives, with every breath that we take. We not only take air into our lungs, but we also breathe air out of our lungs. And the air that we breathe out is quite different from the air we breathe in.

8. In the act of breathing, air passes through the nose and mouth down the throat into a network of very small tubes, which form the lungs. At one side of these fine tubes is the air, and at the other side is the blood.

9. The oxygen in the air passes through the thin sides of the air passages of the lungs into the blood. There it combines with the carbon in the body. When oxygen and carbon unite, a new gas is formed, called carbonic acid gas.

10. This new gas mixes with the nitrogen, and together they form the air which we breathe out. Thus, we breathe in air composed of nitrogen and

oxygen, and breathe out air composed of nitrogen and carbonic acid.

11. Now, carbonic acid gas is a deadly poison. If we breathed it into our lungs by itself, it would kill us. We should die just in the same way as persons do, who are choked by the stopping up of the air passages.

12. Therefore, air which contains much carbonic acid gas is impure, and not fit to breathe. Thus we see how we ourselves are constantly changing good air into bad air, by taking out the oxygen and putting carbonic acid into its place.

13. We also see that we cannot prevent the change going on ; it is a part of our lives. The turning of oxygen into carbonic acid in our lungs keeps up the heat of our bodies, and enables us to live. How, then, can we prevent breathing the bad air we make ?

14. There are two ways. We can go out of the room into the fresh air, and we can change the bad air in our rooms for good air. This change can be made by keeping the air in a room constantly moving. A current or stream of used air should be always passing out of a room, and another current or stream of fresh air should be always coming in. This is called ventilation.

15. If we do not change the air in our rooms, we breathe it over and over again, making it

more impure every time it passes through our lungs. Then we begin to feel unfit for work. We cannot think clearly, we suffer from headache, and we are tired. Nor need we wonder at this, when we know that we are slowly poisoning ourselves by breathing foul air.

16. At night, when there are lights in our rooms, the air becomes impure much sooner than during the day. Why? Because candles, oil lamps, and coal gas, change the oxygen in the air into carbonic acid.

17. The same thing happens to the air when it passes through a flame, that takes place when it passes through our lungs. In both cases oxygen and carbon unite and form carbonic acid. And in doing this, heat is formed in the body and by the flame.

18. The burning of coal gas uses up more oxygen than any other kind of light. Therefore, we should spend as little time in the gaslight and as much time in the daylight as we can. Daylight is much healthier, and, as we know, very much cheaper than gaslight.

## NOTES ON COLOURED PICTURES

1. **The box** is an evergreen shrub, with densely-crowded branches and leaves. It grows to a height of 12 to 15 feet. A dwarf kind is used for edging garden plots. The leaves are small, simple, and oblong. The flowers are small, of a greenish-yellow colour, and grow in clusters. The wood is yellow, hard, strong, and heavy.

2. **The beech** is a forest tree, which grows more than 100 feet high. The bark is gray, smooth, knobby, and shining. The leaves are simple, slightly toothed, and pointed. The fruit is a three-cornered nut, called mast. The reddish-brown timber is hard, but brittle, and is very durable under water.

3. **The elm** is a forest tree, which grows to a height of 70 to 90 feet. The bark is rugged, and the leaves are simple, rough, notched, and pointed. The flowers grow in clusters. The timber is tough, and strong, and very durable under water.

4. **The fern** is a flowerless plant, which in hot countries grows into a large tree. The leaves are called fronds. The seedholders are small pods, which grow on the under sides or on the edges of the fronds. The seeds are called spores.

5. **The ivy** is a climbing evergreen plant. It has a woody stem, and dark green, smooth, leathery, shining leaves, having three or five lobes or parts. The ivy climbs up the walls of buildings, clinging for support by means of the tufts of fibres, which are produced from the stem. If it can find no support, it creeps along the ground.

6. **The holly** is an evergreen tree or shrub, which bears dark-green, tough, leathery, glossy leaves. They have a wavy surface, and are curved, sharp-pointed, and prickly at the edges. The small white flowers grow in bunches. The berries, which contain the seeds, are small, round, smooth, and of a bright red colour. The wood is white and hard.

7. **The oak** is a forest tree of noble appearance. The trunk is thick and tapering. The branches are long, thick, and wide-spreading. The bark is rough and brown. The leaves are simple, somewhat oval, and deeply indented. The fruit is called an acorn. The timber is very hard and durable.

## 7. HOW PLANTS GROW FROM SEEDS.

### Plants—

Bear seeds.

Grow from  
seeds.

### Seeds—

Look dead.

Are sown.

Sprout.

### Seeds—

Send down roots.

Send up stems.

Grow into plants.

1. A dry seed looks as if it was dead, and yet it is only asleep. Sometimes it will remain in this state for a long time, often for years. The living part is enclosed in the vessel or case, which protects it from harm. And in this case it lies secure, waiting for the time when it may be planted in the ground.

2. We do not know how long some seeds will keep the life which gives them power to grow. Not long ago some grains of corn were found in a stone coffin in Egypt. They had been there thousands of years, yet when they were brought to England and sown they grew into plants and bore fruit.

3. How does a seed grow? When it is put into the warm ground, the moisture, that is, the dampness, in the soil gets into it, and causes it to swell and burst its covering. Then it begins to sprout. A little root pushes its way down into the ground, and a little stem finds its way up above the ground.

4. What makes the root go down and the stem come up? I cannot tell you. No one knows, though many wise men have tried to find out. We only know that this is the way a plant grows, and we call the part which strikes downwards from the seed the root, and the part which pushes upwards into the air the stem.

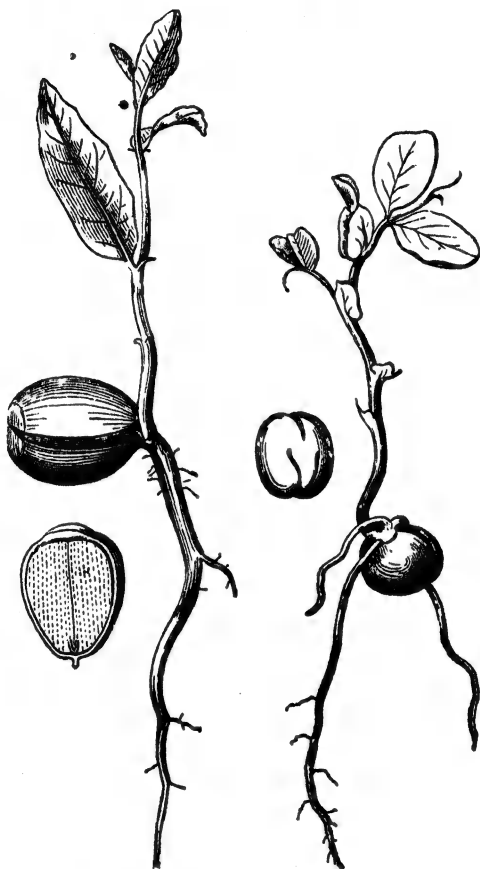


SEED GROWING.

5. A pea is a seed. If we put it into the ground it will begin to grow. A plant will come up from it. Leaves will grow out of the stem. Next flowers will appear, and then pods, in which we shall find a number of peas of the same kind as that which we put into the ground.

6. An acorn falls from an oak-tree, and, it may be, a cow feeding in the field treads on it and presses it into the ground. It takes root, and a small shoot appears, and grows slowly into a giant oak. The huge trunk, the wide-spreading branches, the green leaves, the flowers, and the acorns, have all come from that one acorn.

7. We plant or sow a grain of corn. Soon green leaves appear, and a stalk grows up, on which we see an ear of corn. And of all this



ACORN GROWING.

PEA GROWING.

plant only the grains of corn found in the ear are like the seed we put into the ground.

8. As in the pea, the oak, and corn, other

plants are fitted to produce similar plants from seeds of plants, once seeds themselves. The

life and growth of a plant begins with a seed and ends with a seed.



CORN GROWING.

9. Is not this very wonderful? Yet thousands, nay, millions of plants, are growing around us in our gardens, in our fields, and in our woods, and we seldom think how they are produced.

10. Nearly all plants bear seeds of some kind, but gardeners often grow new plants without sowing seeds. If you look at a plant or a tree in the winter or spring, you will see little swellings or buds on the stem or branches, which

will by-and-by push out and grow into new branches when the warm weather comes. (See page 92.)

11. If we cut off a piece of a branch with several of these buds on it, and stick it into the ground, so that some of the buds are covered by

the damp earth, while others remain exposed to the light and air, the parts below the surface will grow into roots, while the parts above ground grow into branches. In this way new plants may be grown.

12. The parts taken from the old plant are called cuttings, and any boy or girl who takes pains can soon learn the right way of growing plants from some one who knows.

13. There are some plants in which the branches or stems lie flat on the ground when they grow long, and sometimes it is enough for the buds only to touch the earth in order that new roots may grow from them. You may see this in any garden where there are strawberry plants. (See page 50.)

14. The branches, or "runners," as they are called, push out from the plant along the ground, and from the buds little roots strike down and little leaves push up, until little new plants are formed. In the autumn the part of the stem between the new plant and the old plant dies. Then the new plant lives by means of its own root and leaves. The blackberry bramble also roots wherever the tips of its long shoots or branches droop or touch the ground.

## 8. ALL ABOUT BUTTONS.

Buttons—	Buttons are made of		Buttons are—
Fasten garments.	Bone.	Copper.	Punched.
Are ornaments.	Horn.	Brass.	Stamped.
Hold firmly.	Glass.	Pearl.	Pressed.
Look neat.	Wood.	Ivory.	Moulded.
Are cheap.	Steel.	Cloth.	Covered.

---

1. If you wish to form an idea of the great use buttons are to us, count the number of buttons on your garments, and try to think what you would do without them. We have no other article which can for a moment be compared with the button for fastening clothing.

2. How many things can be said in favour of this useful article? Buttons are cheap, they fasten quickly and easily, they hold firmly, they look neat and often very pretty, and they can be obtained in endless variety.

3. Buttons are of all sizes and are made of a great many different materials to suit different purposes. They are made of metal, bone, horn, glass, wood, pearl, real ivory, vegetable ivory, and all kinds of cloth. There is scarcely a material that has not been used for this purpose.

4. The common metal buttons are punched out of sheet brass, and stamped to make them hollow

in the centre and thick in the rim. Then the holes for the thread are punched in them.

5. Linen buttons are made by stretching three layers of linen-cloth, two on the face and one on the back, over a metal ring. The cloth and the ring are placed together in a machine, and in a moment the edges of the cloth are tucked into the slit in the ring, and the latter is squeezed together so as to nip the cloth firmly.

6. Linen buttons have not been in use for more than about fifty years. As they can scarcely be destroyed in washing and mangling, they are of great value for under-clothing and garments which have to be washed.

7. Cloth-covered buttons are made of metal, cloth, canvas, and millboard. These are all punched out of sheets and then brought together. By means of a press the cloth covering is firmly fastened to the metal, and a part of the canvas lining is pressed through the hole in the under-part. This canvas forms the tuft by which the button is sewn on to the garment. The millboard forms the stuffing of the bottom.

8. Buttons made of vegetable ivory are now used. This is the kernel of a palm fruit called the corozo nut. It is ivory-like in appearance, but cheaper, and more easily worked than real ivory. It may be dyed any colour.

9. Glass buttons are made of many shapes and colours by moulding melted glass, or by cutting out of sheet glass. Porcelain buttons are made by moulding china clay.

10. Mother-of-pearl buttons are made of the shell of the pearl oyster, which is as large as a plate and half an inch in thickness. By means of a pipe-shaped saw the shell is cut into round pieces, each of which is again split into three buttons.

11. Many kinds of buttons are made with shanks. In metal buttons the shanks are soldered on; in other materials the shanks have stems which fit into holes in the buttons. Birmingham is the seat of the button trade.

**Learn**—LESSON 8, *page* 180.

## 9. THE AIR PLANTS BREATHE.

<b>Air supports—</b>	<b>Animals—</b>	<b>Plants—</b>
Animal life.	Breathe oxygen	Breathe carbonic
Plant life.	in, and carbonic	acid in, and
All life.	acid out.	oxygen out.

1. Every living thing must have air to support life. Without air persons, animals, and plants would die. Both persons and animals are so much alike in their bodies that they need the

same kind of air. They breathe in nitrogen and oxygen, and breathe out nitrogen and carbonic acid.

2. Then how is the supply of oxygen kept up? Is there not a danger of the air becoming altogether bad, and having in it so much carbonic acid as to make it all poisonous?

3. There might be, but for one thing. Plants need air just as much as we do. But while we must have oxygen in our air, they must have carbonic acid in theirs. And while we breathe out carbonic acid, they breathe out oxygen.

4. Thus we see that animals and plants play opposite parts, and so keep each other supplied with the right kind of air. Animals make the air impure by changing oxygen into carbonic acid, and plants purify the air by taking up the carbonic acid and breathing out oxygen.

5. How is this work done by plants? Somewhat in the same way that similar work is done by animals. Plants are living things, and they eat and drink to support life, and to increase by growth.

6. They obtain food by means of their roots and leaves, partly from the soil and partly from the air. Both kinds of food are needful to many plants, but by far the larger part of plant food comes out of the air.

7. This work is done by the leaves, which act as the mouths and stomachs of plants. By means of tiny holes or pores the leaves suck in or swallow the carbonic acid gas, some of which is always floating about in the air. This gas is the chief source of the solid material of plants.

8. When the leaf has obtained the carbonic acid, it passes the gas into the green cells, which form the life material of the plant. The name "cell" is given to the tiny parts, or bags of juice, of which plants are formed, and which are often so small that we cannot see them separately with the naked eye. In the pulp of the orange the cells are large enough to be seen.

9. The green cells act as stomachs. In them carbonic acid and water are turned by the sunlight into starches and sugars, and other materials of which plants are made. In doing this work the leaf sets free the oxygen it does not require.

10. Then, just as the carbonic acid which we breathe out mixes with the nitrogen and forms impure air, so the oxygen which plants breathe out mixes with the nitrogen and forms pure air.

11. Now we know one reason why the air of towns is less pure than country air. It is because there are more people to breathe it, and use up the oxygen it contains, and fewer plants to take in the carbonic acid and give back oxygen.

12. We also see the need for people, who live in the close streets and crowded alleys of towns, to take a holiday in the country or at the seaside as often as they can. The change from the impure air of towns, which contains not only more carbonic acid gas, but also specks of dust and dirt, to fresh pure country or seaside air does great good even to persons in health. But those who are weak, or who are recovering from illnesses, receive a yet greater benefit from such a change. Indeed, in some cases there is no other way of restoring them to health and strength.

---

Learn—LESSON 9, page 180.

## 10. THE ROOTS OF PLANTS.

### Roots—

Grow downwards.

Feed plants.

Fix plants in the ground.

### Roots—

Are fibrous, as the celery.

Are fleshy, as the turnip.

Are woody, as the oak.

1. A plant is a living thing, and all living things need food and rest. Plants may be said to eat and drink, and some of their food is obtained out of the ground. The roots get this nourishment from the soil.

2. How is this work done? The root of a plant has a great many openings, like the holes

in a sponge, but much smaller. These are its mouths, and through them it sucks up water out of the ground. This water, however, is not pure. It contains substances which it has dissolved or made liquid, some of which the plant needs.

3. If we melt a lump of sugar in a glass of water, we can taste the sweetness in the water, although we can no longer see the sugar. So a plant finds some of its food in the water which it sucks up. For the ground contains things which are melted or dissolved in water.

4. All plants do not need exactly the same kind of food, and each root takes in only the substance it requires. Some plants wither away because they cannot find the right kind of food. That is one reason why a plant will grow better in one piece of ground than in another.

5. Farmers know this, and so from time to time they change their crops. If they were to sow corn in the same field year after year, the crops would become poorer and poorer. The food needed by corn would get used up, and at length the plants would starve. To enrich the soil, different kinds of plant food are put into the ground, called manure.

6. The root has another use. It fixes the plant in one spot and holds it firmly in the ground. All the time that the stem is growing

larger and larger above the ground, the root is growing larger and stronger below the ground. And just as the stem throws out branches, so does the root. And these root branches, or rootlets, lay hold of and cling to the earth.

7. This is why it is not easy to pull up even a small plant by the roots. It also explains how trees remain fixed firmly in spite of strong winds, which seem to do their utmost to blow them down. Trees bend to and fro, and sometimes even break off, before they can be uprooted.

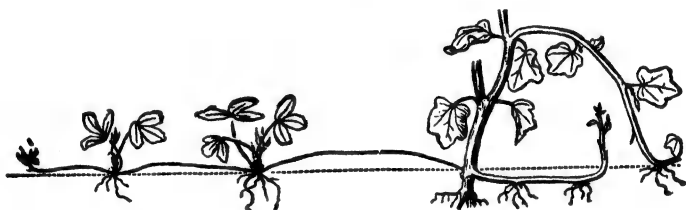
8. The coloured picture at the beginning of this book shows several different roots; (1) celery, (2) onion, (3) strawberry, (4) turnip, (5) carrot. Some roots are made up of thread-like fibres or rootlets, that is, little roots.

9. The onion has a fibrous root, which grows out of a bulb. This is formed of thickened leaf-stalks or scales which grow under the ground. The bulb sends roots downwards from its lower part, and a stem upwards from its centre. The second year one or more buds in the centre of the bulb grow from seed. They feed on the food laid up in the scales, and make the stalk of the season, which bears the flowers and seeds.

10. The strawberry plant is called a runner, because it throws out branches called "runners," which run along the ground and take root. At

the tip of the runner there is a bud, from which the plant grows. From this habit the plant has received the name "strayberry," or strawberry.

11. The runner dies in winter, and leaves the young plant to grow alone. Then it throws out runners of its own, which make new plants at their tips. A single strawberry plant produces a number of new plants in this way every season. Currant bushes, brambles, white clover, and some

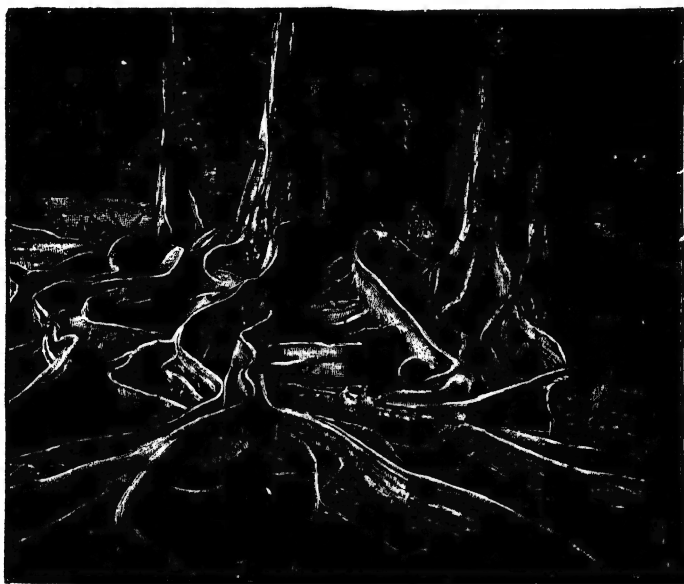


RUNNERS.

other plants, that spread and increase in this way, are sometimes called "plants which walk."

12. The turnip and the carrot have large fleshy roots, out of which grow a great many fine, hair-like rootlets or fibres. These are called tap roots. They contain food for the next year's growth of the plant, when it has to bear flowers, fruit, and seeds.

13. Large trees have tough, woody roots, which branch out in every direction, and spread rootlets on every side. They go in and out, above and



ROOTS OF INDIA RUBBER TREE.

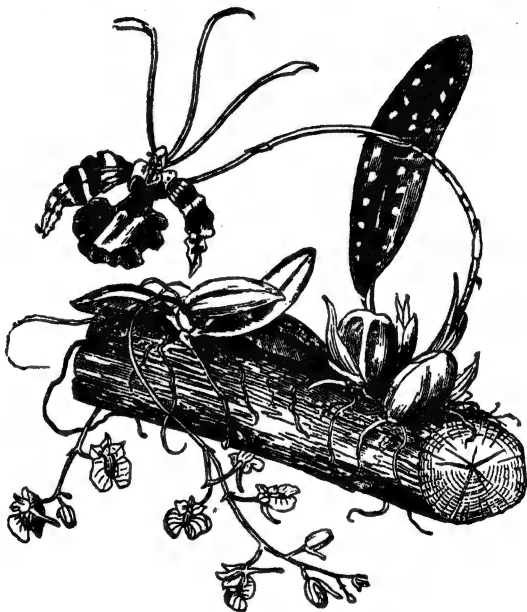
(From the "*English Illustrated Magazine*.")

below, wherever they can find the food they require, and, at the same time, firmly fix the trunk in the ground. How roots spread out may be seen in the india rubber tree, the roots of which are largely on the surface of the ground.

14. Seeds are sometimes blown or carried by birds and animals into strange places. Once a seed took root in the scanty earth that had gathered on an old wall. When the plant had used up all the food there, the roots found their

way to the bottom of the wall, and, striking into the ground, obtained all they needed.

15. Some plants strike their roots into the bark or wood of trees and feed on the sap. The mistle-toe grows in this way. There are also plants which



AIR PLANTS.

have roots that never reach the ground. These plants grow in trees, but do not take root in them or receive nourishment from them. They live on air, and are called air plants or tree-dwellers.





## NOTES ON THE COLOURED PICTURES.

1. **The primrose** is a plant which bears small flowers, somewhat bell-shaped, and of such a beautiful delicate yellow colour that this shade is known by the name of the flower. The leaves are egg-shaped and wrinkled, and the flowers grow each on a separate stalk. The name "primrose," from the Latin *prima rosa* ("first rose"), refers to its early appearance in spring. It grows wild, and is cultivated in gardens.

---

2. **The violet** is a small plant, with heart-shaped leaves and short stems. The flowers are deep purple, lilac, pale blue, or white. The deep purple or violet flower has given its name to a colour of that shade. Sweet violets, as they are called from their delicious fragrance, are favourite wild flowers. This flower is abundant in fields and woods. The pansy, or heartsease, is a variety of violet.

---

3. **The honeysuckle**, or woodbine, is a climbing or twining shrub, which bears funnel-shaped, gaping, or two-lipped flowers. They are of a beautiful cream colour tinged with red, and have a very fragrant smell. The branches shoot out and twine round other trees for support. The honeysuckle is often trained against a wall or over a porch.

---

4. **The buttercup** bears bright yellow, cup-shaped flowers. There are many varieties, some of which grow wild; others are cultivated in gardens. The crowfoot and the lesser celandine belong to the same family, and are often called buttercups. This flower grows chiefly in meadows, but some kinds are altogether water-plants.

---

5. **The water-lily** has large heart-shaped leaves, which float on the water. The beautiful and fragrant white flowers also float on the water during the day, but close and droop upon, or sink below, the surface during the night. There is also a yellow variety. This plant grows in lakes, ponds, and slow-flowing streams.

---

6. **The daisy** is called a compound flower; that is, each flower is made up of numerous smaller flowers called florets. The centre or disc of the flower is yellow, and the rays, which stand out from the centre, are white, or white tipped with pink. It grows abundantly in fields. It is called daisy ("day's eye") because it closes at night.

## II. HOW PINS ARE MADE.

<b>Pins—</b>	<b>Wire is—</b>	<b>Pins are—</b>
Fasten.	Drawn.	Headed.
Are brass, steel.	Wound.	Pointed.
Have heads.	Straightened.	Whitened.
Have points.	Cut into lengths.	Polished.

1. Pins are so cheap and so common, that we think nothing of asking each other for one or of giving one away. A paper of pins, containing two hundred and fifty of these useful articles, may be bought for one penny.

2. At one time pins were such costly articles that only rich people could afford to buy them. So that ladies might be able to supply themselves with pins, it became a custom for husbands to allow their wives a certain sum every year for this purpose. This was called "pin money," and the name is still given to the money allowed to a wife for her own use.

3. Until about fifty years ago all pins were made by hand, and each one passed through the hands of fourteen persons. The heads were made separately, and consisted of a piece of wire twisted round the top of the shank. These heads often came off when the pins were in use.

4. Pins are now made by machines, attended by boys, who have only to see that they are

running properly, and to keep them supplied with wire. In fact, the whole process, from the wire to the perfect pin, is done by one machine.

5. Common pins are made of brass wire. The wire is made the right thickness by drawing it through holes in a steel plate. Each hole is smaller than the last, and so the wire is made thinner every time it passes through a hole. Drawing the wire also makes it hard and stiff.

6. When the wire is ready for pin-making, it is coiled or wound round a reel, like a bobbin of thread, at the back of the machine. A pair of pincers take hold of the end of the wire, and pull in enough wire to make one pin.

7. This length is at once cut off, and certain movements of the machine stamp the head and sharpen the point. Heads made in this way are solid, and, as they are formed out of the same piece of wire as the rest of the pin, they do not come off.

8. The machine does its work very quickly, and turns out one hundred and sixty complete pins a minute. They are then cleaned and coated with tin, which gives them a silvery colour. After this they are polished by shaking them in a bag or barrel containing sawdust or bran.

9. Another machine, which a girl can work with her foot, sticks the pins in paper, a row at a

time. Pins are also sold by weight, and made up loose into packets. Though most of the pins we buy are made of brass wire, steel pins are coming into use. They have much sharper points than common pins, and do not bend so easily.

10. Pins are made in many sizes, and for various purposes. Black pins are used by persons in mourning. They are made black by heat, or by coating them with black varnish. Shawl and blanket pins, and also bonnet pins, are several inches in length. Safety pins are made with the point resting in a loop. They are not easily displaced, and will not prick the wearer.

11. Pins for ornaments are made of silver and gold. The heads are worked in many patterns, and some of them are of great beauty and very costly. The heads are sometimes formed of diamonds or other precious stones. Birmingham is the chief centre of the pin industry. It is said that fifty million pins are made every week in England.

---

**Learn—**LESSON 11, *page 181.*

---

## 12. WHAT IS WATER?

<b>Water is—</b>	<b>Water is—</b>	<b>Water exists—</b>	<b>Water is—</b>
A substance.	Heavy.	In animals.	Oxygen com-
A fluid.	Transparent.	In plants.	bined with
A liquid.	Sparkling.	In the air.	hydrogen.

---

1. Water is the world's drink. It is the one liquid provided by nature for all living things. Men and animals and plants must have a supply of water, or they will die.

2. Next to air, water is one of the most common things in the world. Air is everywhere, because it surrounds the earth like a mighty envelope ; but there are parts of the world where no water is found. In these regions there are no plants, and neither animals nor men make their homes.

3. About three-quarters of the earth's surface is covered with water. By looking at a map of the world, we see at a glance how much more water there is than land. It forms the great oceans, the seas, the lakes, and runs over many parts of the earth in countless streams and rivers.

4. But that is not all ; water forms a large part of all animals and plants. Three-fourths of the entire weight of every person consists of water.

5. Where is the water in our bodies ? In every part of them, helping to form our flesh and our

bones. Some of it comes away when we breathe, when we perspire or sweat, and in other ways, through the pores of the skin, the lungs, and the kidneys.

6. Plants also contain a good deal of water. Some of them, such as cabbages, consist almost entirely of water. Even solid vegetables, as potatoes, carrots, and turnips, are more than three-parts water.

7. Last of all, there is a large quantity of water in the air in the form of vapour. This is sometimes called steam. It collects in clouds, and often falls to the earth in the form of rain, hail, and snow.

8. Now, so far, we have been reading about water, but we have not yet answered the question "What is water?" This we will proceed to do.

9. We have learned that oxygen and nitrogen are two natural gases, which mix together and form another gas called air. There is also oxygen in water, but to form this liquid it is united with a gas called hydrogen.

10. These two gases do not exist in water in equal quantities. Nine pounds of water consist of eight pounds of oxygen and only one pound of hydrogen. When pure, water contains no other substance except these two gases.

11. But, though water is plentiful, it is never

found wholly pure. The purest is that which falls from the sky as rain, but even this is soiled with such matter as dust and smoke washed out of the air. It also takes up various gases, including carbonic acid.

12. The water which falls on the ground runs over the surface of the earth. Some of it at once makes its way to streams, rivers, ditches, ponds, and lakes. Much of it sinks into the ground, and appears again in the form of springs.

13. While in the ground and running over its surface, water takes up sand, soil, dirt, and both animal and vegetable matter. It also melts or dissolves minerals, and retains them in a liquid state. In this way we find water containing salt, lime, soda, iron, and other substances.

14. These things, which are taken up or dissolved in water, often make it impure and not fit to drink. They also make it hard, so that soap will not easily make a lather with it. Still, all mineral waters, or water which contains dissolved minerals, are not hurtful. Some towns are famous for their mineral springs, and are visited by persons who go there to drink the waters.

## 13. THE STEMS OF PLANTS.

**Stems—**

Grow upwards.  
Contain sap.  
Form branches.  
Produce leaves

**Stems—**

Are pithy.  
Are woody.  
Grow from the outside.  
Grow from the inside.

1. We have seen how roots differ in different plants ; now we shall find that the stems are not all alike. But first of all let us consider the work of the stem ; for it is one of the three parts which has to do with the life of the plant.

2. The root sucks or pumps up watery food out of the ground, and this food, in the form of juice, called sap, must find its way to all parts of the plant. This it does by passing up through the stem. And just as the blood is always moving through the small tubes to all parts of our bodies, so the sap is always moving through tiny passages to all parts of a plant.

3. Stems are made up of two parts. One is soft and fleshy, and is called pith. The other is hard, fibrous, and woody. Some stems contain little wood and much pith, and others contain a good deal of wood.

4. Those plants which have little or no wood in their stems die down in the autumn. Some of them, called annuals, live only one year. In some

plants the flowering stem dies down, but the real stems or root-stocks live through the winter, and new flowering stems come forth in spring.

5. Plants with woody stems often live a great many years. Some of them, however, cast their leaves in autumn and grow new ones in spring. Others retain their leaves all the year round. These are called evergreen plants.

6. There are two great classes of stems, which are known by the way the woody part is arranged, and the manner in which it grows or forms as the plant increases in size. One class grows from the outside, and the other class grows from the inside.

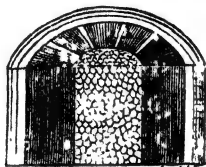
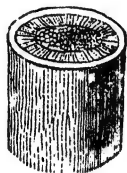
7. The outside grower has the woody part of the stem between the pith in the centre and the bark on the surface. And each year that the plant lives, the stem forms a new layer of wood on the outside of that of the previous year. •All our trees and many of our smaller plants form their stems in this way.

8. As the growing part of the stem is just under the bark, it is full of sap, and is formed of new soft wood called sap-wood. The older wood, which every year gets buried deeper and deeper in the trunk, is much harder, and because it is next to the pith it is called heart-wood.

9. If you wish to know how old a tree of this kind is, you have only to cut it across the trunk.

Then count the number of rings formed round the pith. Each ring shows one year of growth.

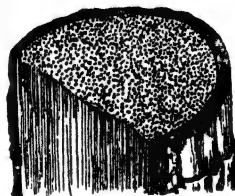
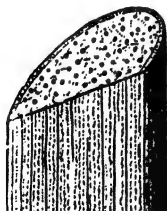
10. You must not think that outside growers are all large plants with thick, woody stems.



OUTSIDE GROWERS.

They are not. The violet, the pink, the flax plant, the pea, and the primrose, belong to this class.

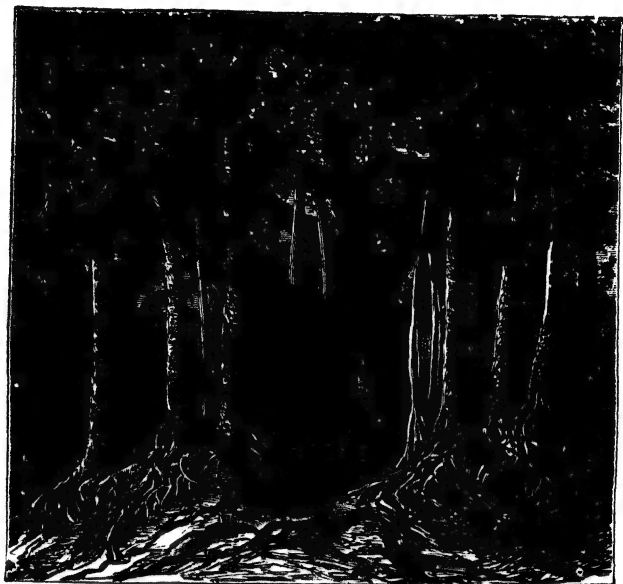
11. The inside grower has the fibrous or woody part of the stem in single threads or in bundles of threads mixed among the pith. The fibres do not form rings, or layers, and increase by a layer every year, but new threads form



INSIDE GROWERS.

among the old, and the stem becomes larger from the inside.

12. The palm, which grows in hot countries, forms wood, and yet it is an inside grower. So also are the lily, the tulip, the onion, the rush, and all grasses and plants with straw stems.



THE BANYAN TREE.

## 14. CURIOUS STEMS.

## Stems—

Grow upright.

Climb, } Need support.

Twine, }

## Stems—

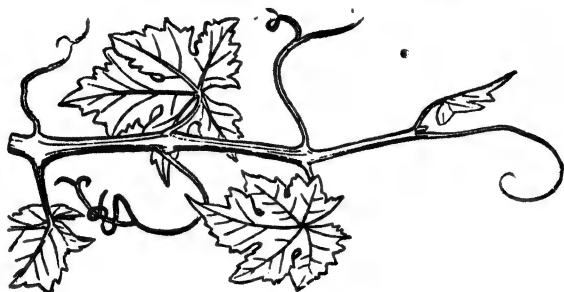
Run on the ground.

Run under the ground.

Form bulbs and tubers.

1. The stems of plants grow upwards from the roots, and many of them stand upright, and are often strong enough to support branches bearing leaves, flowers, and fruit. Other stems are weak, and cannot even support their own weight.

2. Some plants rise by climbing. They lay



GRAPEVINE TENDRILS.

hold of other objects for support. The ivy holds on by means of little rootlets, which act like hold-



BINDWEED.

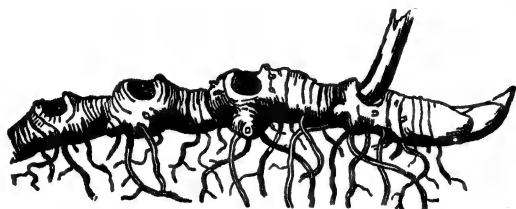
fasts. The pea and the vine throw

out small stem or leaf supports, called tendrils, which hook round and so lay hold of any support.

3. Some plants rise by twining. They coil, or twine, round and round upright stems or poles fixed in the ground for their support, growing taller and taller all the time. The scarlet-runner, the hop, the bindweed, and the honeysuckle are twining plants. Climbers and twiners are often trained to run up the walls of houses and along the sides and over porches.

4. Some plants do not rise from the ground at all. They have what are called prostrate stems. And some stems run a little way beneath the surface. They are called underground stems. When a stem of this kind produces roots on the under side and buds on the upper side, it is called a rootstock.

5. Solomon's Seal is a curious plant, which



SOLOMON'S SEAL.

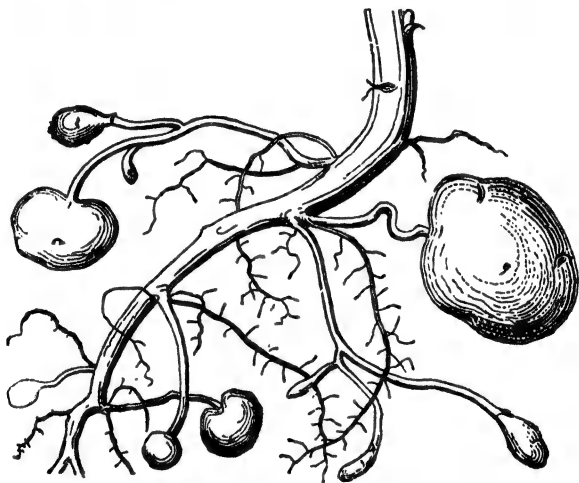
forms a rootstock. It runs along the surface of the ground, growing out a little each year. The new part sends new fibrous roots into the ground, and the upper side bears leaves and flowers. The old part of the stem dies off as much as the new part grows. So that it is always moving on.

6. The large round scars on the rootstock of Solomon's Seal give the plant its name. They are the places from which the stalks have fallen or decayed in previous years, and look as if they had been stamped by a seal.

7. The bulb is another form of an underground

stem. It is seen in the onion and the lily. From the bottom of the bulb, roots descend into the earth, and from the upper part leaves spring forth and the stalks which bear the flowers.

8. The tuber is also an underground stem. It is seen in the potato, which is so often called by



POTATO TUBERS AND ROOTS.

mistake a root. The potato is really the thickened ends of the stem, which live under the ground. The eyes of the potato are buds, and the little scales behind them answer to leaves. From these buds new plants will grow. The real roots of the potato plant are fibrous, and they may be seen growing out of the same part of the stem

as the tubers, or potatoes. Roots never have buds.

9. These swollen stems, which we call “bulbs” and “tubers,” are the savings banks of the plants that produce them. In the thickened stems, the



BULB AND FLOWER LEAVES OF LILY.

starch, sugar, and other substances, are saved or stored up by the plants for future use.

10. In the lesson on roots we have noticed plants which, like the strawberry, throw out runners or branches. These runners bear buds, which root in the ground and form new plants.

11. The famous banyan-tree, which grows in India, strikes new roots from the spreading branches. The ends bend over and grow down to the ground, take root, and form new trunks. A single tree has often hundreds of trunks, and is large enough to shelter thousands of persons.

## NOTES ON THE COLOURED PICTURES.

1. **The dahlia** is a large and bright-coloured garden flower, of which there are many varieties. It is a composite or compound flower, like the daisy. The tiny flowers, or florets, are in the middle of the flower. New plants are obtained from seeds, from cuttings, and from tubers.

2. **The tulip** is a beautiful bell-shaped garden flower. It received its name from the Turkish word for turban, which it often resembles in shape. The smooth, upright stem grows to a height of about 18 inches, and bears one erect flower, mostly of some shade of red or yellow. New plants are largely raised from bulbs. The tulip is prized for its size and beauty, its smell being rather unpleasant.

---

3. **The pelargonium** belongs to the same family as the geranium, and is often called by that name. There are many varieties, all of which are favourite greenhouse flowers. The leaves are marked with dark green rings, and several flowers grow at the top of one flower-stalk. Some kinds, which do not bear very handsome flowers, are cultivated for the pleasant smell of their leaves. So-called "scarlet geraniums" and "ivy-leaved geraniums" are pelargoniums. They grow in the open air in summer.

4. **The carnation** is a very pretty flower of the pink family. The calyx, or flower-cup, is in the form of a tube, with scales at the base. The flowers are very sweet smelling, and are both single and double. The colours are mostly scarlet, purple, and pink, though white, yellow, violet, and brown are seen. The stems are jointed. New plants are usually raised from cuttings.

---

5. **The rose** is the most popular of all flowers, and one of the most beautiful and fragrant. The rose tree is a shrub, which grows to a height of several feet. The stem is generally prickly, and the leaves are compound, having several leaflets attached to each side of a central rib, and ending in a single leaflet. The flowers have many petals, which grow within each other, and are generally of a red tint, called rose colour; but there are also white, yellow, and striped roses. New plants are grown from cuttings.





## 15. HOW NEEDLES ARE MADE.

Needles—	Wire is—	Needles are—
Are for sewing.	Cut.	Parted.
Are made of steel.	Straightened.	Hardened.
Have eyes.	Pointed.	Tempered.
Have points.	Stamped.	Polished.
	Pierced.	Finished.

1. The first needles were strips of bone, wood, ivory, or some kind of metal with sharp points. They had no eyes, and only made holes in the cloth or other materials, through which the thread or string was pushed. They were more like pins, awls, or prickers, than the needles we now use.

2. We do not know when eyes were first invented, but it must have been a long time ago, for bone and bronze needles with eyes have been found in caves and among ancient ruins.

3. One improvement after another was made, until at length steel needles of every size and for all kinds of work were produced in large numbers. So cheap are they at the present time that a packet, containing twenty-five good needles, may be bought for a few pence.

4. A needle seems to be a very simple thing, yet each one passes through the hands of a number of persons, and about twenty processes. The best needles are made of the finest steel wire,

which is sent to the mills rolled up in coils, just ready for use.

5. The wire used for this purpose is not all of the same thickness. The thinnest, for very fine needles, is scarcely thicker than a hair. A coil of wire used in making No. 6 needles contains over a mile of wire, weighs about fourteen pounds, and produces over fifty thousand needles.

6. The wire is first cut into lengths long enough to make two needles. Some thousands of these lengths are made up in a bundle, held together by two steel rings. Then they are made red hot in a furnace, and while in this state straightened. This is done by placing them on a flat iron plate, and rolling them backwards and forwards under a steel bar.

7. Then they are pointed by a grinder, who takes fifty to sixty at once between the thumb and forefinger, and as he presses them against a grindstone, he rolls them round and round. So that the fine steel dust may not do harm by finding its way into the workman's throat and lungs, it is carried off by means of a strong blast of air produced by a fan.

8. When the lengths of wire have been pointed at both ends to make two needles, they are taken to a stamping machine. Here the grooves, or gutters, are stamped in the heads, and dents made

to show where the eyes will be. Then the eyes are pierced by means of a punching machine.

9. At this stage each length is a double needle, like a lead pencil sharpened at both ends, and two eyes near each other in the middle. Through the eyes two lengths of wire are threaded, and the needles are held firm while the ridges caused by the stamping machine are carefully filed down.

10. Now the lengths are divided or parted in the centre, between the eyes, and there is a row of single needles on each wire. They are, however, yet in a rough and unfinished state. Though of the right size and form, a good deal requires to be done before they are ready for use.

11. The heads of the needles, where they were divided, are rough, and have to be made round and smooth with a fine file. Then the eyes receive careful attention. A small file, and it must be a very small one, is passed into each eye, and worked about very rapidly to make the edges perfectly smooth.

12. The needles are next hardened by heating them in a furnace, and then suddenly cooled by plunging them into a large vat of oil. This, however, makes them very brittle, and so they are tempered by being gradually heated and gradually cooled.

13. Sorting comes next, and all the bent

needles are weeded out. They are not thrown away, but are straightened by tapping them with a small steel hammer, and sold at a cheaper rate than the better needles.

14. The fire and the oil have made the needles black, so they are fastened up, a large number together, in a piece of canvas, with a mixture of emery powder, oil and soft soap. Then they are placed in the scouring machine and rolled to and fro for some time, until they are polished and shine like silver.

15. Once more the eyes receive attention, and nothing is left undone to make them smooth, that they will not cut or fray the thread in sewing. In some of the best and finest needles the eyes are gilt. The heads and the points are again carefully ground, and the needles finally polished by means of wheels covered with chamois leather.

16. Last of all, the needles are made up into packets of twenty-five, and labelled with the number or size of the needle and the maker's name. Redditch, a small town in Worcestershire, is the chief seat of this industry. Hundreds of millions of needles are manufactured in that neighbourhood every year.

**16. AIR AND WATER COMPARED.**

<b>Air and Water—</b>	<b>Air—</b>	<b>Water—</b>
Are natural substances.	Is a gas.	Is a liquid.
Are fluids.	Is a mixture of	Is a combina-
Are transparent.	oxygen and	tion of oxygen
Have no colour.	nitrogen.	and hydrogen.
Have no taste.	Spreads every	Always flows
Have no smell.	way.	down.
Have no shape.	Has no surface.	Finds its level.
Have bulk or size.	Changes its size.	Retains its size.

1. Now that we know something about air and water, we can compare them, and find out in what respects they are alike. We shall also see how far they differ from each other.

2. They are both natural objects and form without the aid of man. They also continue to exist without man's aid, and, though he can make them impure and spoil them for his own use, he cannot destroy them. More than that, the impure air and water can again become pure without his aid.

3. Air and water both consist of two gases. They both contain oxygen. But air is a mixture of oxygen and nitrogen, and water is composed of oxygen and hydrogen.

4. Now, though it takes two gases to make air and two gases to make water, air is called a mixture, and water is called a combination. The

difference between them is this, that in a mixture there need not always be the same quantities of both the substances used, while in a combination there are always the same quantities present—no less and no more.

5. Air in a natural state consists of four parts of nitrogen to one part of oxygen, but if this was altered, and there was less oxygen and more nitrogen, it would still be air. Then, again, no change passes over either the oxygen or the nitrogen. The air contains only just the same qualities as the two gases contain.

6. We see the same thing in a glass of wine and water. We may put into the glass a teaspoonful or a tablespoonful of wine and the rest water. But no matter how we mix them together, the liquid, called wine and water, does not contain any qualities except those which belong to the wine or to the water.

7. This is not the case when oxygen and hydrogen are united to form water. In nine pounds of water there are eight pounds of oxygen and one pound of hydrogen. And in all water these proportions are the same. They never vary. Water is only made in this way.

8. Then again, hydrogen is a gas which takes fire and burns, and oxygen is a gas which supports fire or burning, and also animal life.

But when these two gases combine in exact portions and form the liquid called water, they undergo a complete change. They no longer possess the properties they each possessed singly, and as water they possess new properties.

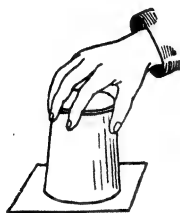
9. And now, to continue, we notice that pure air and pure water are both without colour, without smell, and without taste. They are also both transparent. We can see through a glass when it is "empty"—contains only air—and also when it is full of water. Air, however, is more transparent than water, because it is less dense. That is, the particles of air do not lie as close together as the particles of water.

10. Again, both air and water are fluids. When they are free to move about, they flow in a body from one place to another. They cannot remain still unless they are confined and in some way kept from moving.

11. If we open a door or a window the air will at once enter the room. If we move an article or change our places, the air will fill up the vacant places. If we make a hole in the side of a dam, or in the bottom of a barrel containing water, the contents at once will flow out.

12. Air, however, flows in every direction where there is space for it to go. It will ascend or descend, as the case may be. It presses

equally in all directions. If we fill a tumbler full of water, and cover it with a sheet of paper, then hold the paper well in its place with the flat of one hand, and turn the tumbler upside



down, the water will not fall out when the hand is taken away. The air pressing upwards against the paper will keep in the water. Water, however, only flows down. It is always trying to get lower. Without force it cannot flow uphill.

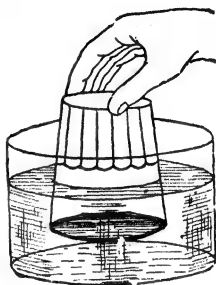
13. Air, being a gas, has no surface. It simply spreads itself to fill vacant space. Water, being a liquid, spreads itself out so as to make a level surface. Thus, we say that "Water always finds its level." A body of water, that is free to flow, continues to do so until every part of it is standing at the same level.

14. Both air and water have bulk or size, because they occupy space which nothing else can fill at the same time. But air does not retain its size. The air which fills a quart bottle can be squeezed or pressed into a pint bottle, or one even smaller. On the other hand, the water which fills a quart bottle cannot be forced into a smaller bottle. Water therefore retains its size.

15. We may test this for ourselves by turning an "empty" tumbler upside down in a glass dish

of water. If we push the glass down we shall see the water rise a little way in the tumbler. Thus the water will retain its size, but the air that filled the tumbler before it was pushed into the water, will be squeezed into less space.

16. Neither water nor air has any shape or form of its own. Both of these substances take the form of any article or vessel in which they are confined. They at once spread themselves out to suit either a square vessel or a round one.



17. It may be well to finish this lesson by comparing solids, liquids and gases :

(1) In a solid the particles stick well together, and cannot be easily separated. Therefore a solid retains its size and shape.

(2) In a liquid the particles stick together only slightly, and can be easily separated. Therefore, while a liquid retains its size, it changes its shape.

(3) In a gas the particles do not stick together at all. Therefore a gas changes both its size and its shape.

## 17. HOW CROCKERY IS MADE.

Crockery materials are—	The Materials are—	
Blue clay.	Crushed.	Thrown.
Cornish clay.	Mixed.	Fired.
China stone.	Strained.	Printed.
Bones and flint.	Boiled.	Glazed.

1. The art of making crockery—that is, pots from clay—is carried on in all parts of the world where there is earth fit for the purpose. Rude pieces of pottery are often found when digging up the ground in various parts of our island, showing that this art was known long ago.

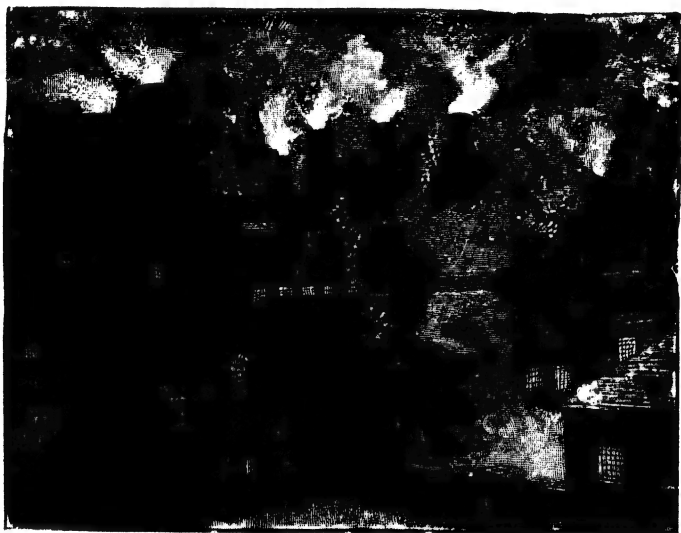
2. The pottery trade is now largely carried on in North Staffordshire, with Stoke-on-Trent as the centre of the industry. This district is called “the Potteries.” All the materials used in the making of earthenware, except one, come from a distance. The blue clay is brought from Poole Harbour, in Dorsetshire; and the white china clay and china stone are brought from Cornwall.

3. The one material found on the spot is a kind of coarse clay, used for making cases for holding crockery in the kiln. So much of this clay is required, that its carriage would cost as much as all the rest of the materials put together.

4. Powerful crushing machines and mills reduce the Cornish stone, the flints, and the bones, to a

smooth white paste before they are mixed together. The blue clay makes the ware tough and solid, flint makes it white, and the Cornish stone binds it all together.

5. When the materials have been weighed and



STOKE-ON-TRENT.

(From the "*English Illustrated Magazine*.")

measured, they are placed in a large vat, water is added, and they are well mixed together. Then they form a beautiful white fluid called "slip."

6. The slip is forced into bags of white cloth, to get rid of the water. It is then ready for the thrower. This workman uses what is called the

potter's wheel. This consists of a small table, which is kept turning round.

7. On such a wheel the slip, which looks like stiff dough, is placed. The wheel is set in motion, and the shapeless mass is quickly moulded, as if by magic, into a cup, or bowl, or any other article. The skilful workman is able to produce any shape by the simplest movement of his hands.

8. With no tools, excepting the "wheel" and his fingers, the workman is able to fashion any number of articles of exactly the same shape and size.

9. Flat ware, such as dishes, saucers, and plates, are made by pressing. The presser lays the clay on a mould of the shape he requires, and then gives the table a touch, which causes it to revolve like a potter's wheel. He then presses the clay with a tool made for that purpose, and it takes the required shape.

10. The next process is that of firing. This is the greatest test through which the earthenware has to pass. All the work is done so that the material may not suffer when the ware has to be fired. Before the articles which have been thrown, turned, or moulded, are put in the kiln, they are placed in cases of coarse clay, which have the appearance of thick, strong pie dishes.

11. Care is taken to prevent the pieces of ware from touching each other, by placing between



POTTER AT WORK.

(From the "*English Illustrated Magazine*.")

them bits of pottery made for the purpose. The cases, or dishes, are then piled one on the other, and the fire is applied by means of the flues so as to produce very great heat throughout every part of the oven. To prevent the ware from cracking, the heat is applied gently at first.

12. When cold, the articles are known at this stage as "biscuit ware," and are ready for painting or printing. This is done by means of designs on transfer paper, which is afterwards taken off; it leaves the pattern on the ware.



## PRINTING TRANSFERS.

(From the "*English Illustrated Magazine*." )

13. The articles are then fired again for a short time at a lower heat, and afterwards dipped into liquid glaze—a form of ground glass—to give them a nice finish. They are then re-fired, and the potter's work is done.

14. The handles are made separately, and are fastened to the cups and other articles by means of a little liquid slip applied with a brush. So well are they fastened on that handles may break, but they rarely come off. This part of the work is done before the ware is fired.

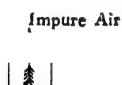
**Learn—LESSON 17; page 183.**

## 18. AIR CURRENTS.

<b>Air currents—</b>	<b>Heat—</b>	<b>Hot air—</b>
Ventilate rooms.	Uses oxygen in air.	Ascends.
Are caused by	Expands air.	<b>Cold air—</b>
heat and cold.	Makes air lighter.	Descends.

1. In the lesson on “The Air We Breathe,” we learned that the way to keep the air fresh in a room is to change it as often as possible. This is done by means of air currents. The bad air must flow out of the room and the good air must flow in to take its place.

2. To understand this, we get a small box and cut two holes in the lid, one near each end. Then we must place a lighted candle in the box, so that



it may appear through one of the holes, and place a lamp chimney over each hole.



3. This will cause an air current to pass down the chimney without the candle, and up the chimney with the candle. To

prove this, make a piece of paper smoke, and let the smoke pass over the top of the chimney without the candle. Then the smoke will be drawn down that chimney, and come up the other.

4. This shows that there is a downward current of air through one chimney, which passes along through the box, and forms an upward current through the other chimney. That is to say, impure air, out of which the flame has taken the oxygen, is passing out of one chimney, and fresh air is passing in at the other.

5. Now, what causes the upward current? The flame from the candle heats the air in the chimney, and as warm air expands, it is lighter than cold air, so it at once rises, and fresh air rushes in to take its place. Hot air and cold air must keep moving, the one is always in a hurry to get away, and the other is just as eager to take its place.

6. This is how rooms are ventilated, that is, the air changed. The air inside a room is always warmer than the air outside, and it escapes by the chimney or window, or wherever it can find an opening. The draught is greatest when a fire is burning in the grate.

7. It is always best to allow fresh air to enter near the top of a room, by the upper sash of a window or by a ventilator, then the cold air will sink to the bottom of the room and drive out all the impure air.





## NOTES ON THE COLOURED PICTURES.

1. **The cherry** grows on a large tree, which belongs to the rose family. The flowers or blossoms are white, and are arranged in tufts. The cherry is one of the smallest of stone-fruits. The flesh is soft and pulpy, and when ripe very juicy. Cherries grow in bunches, and each one is at the end of a long stalk. They are usually red, pink and white, or black. The stone contains the kernel or seed.

---

2. **The plum** grows on a large tree, which belongs to the rose family. The flowers or blossoms are white and showy. The plum is larger than the cherry, but less juicy. There are many varieties, which differ greatly in size, colour, and flavour. The plum and the damson are purple, or plum-coloured. The greengage is green. Plums contain stones with kernels inside. Prunes are dried plums.

---

3. **The apple** grows on a large tree, which belongs to the rose family. It has wide-spreading branches, and pink and white flowers, which grow in clusters. The apple has a firm, hard, juicy pulp, in which are enclosed the seeds, or pips. There are many varieties, and some are highly prized for their rich flavour. The apple is a very wholesome fruit.

---

4. **The pear** grows on a large tree, which belongs to the rose family. The white flowers grow in bunches. The pulp of the pear is much like that of the apple, but of a different flavour. In shape, the apple is round and the pear is oblong. Pears also contain pips.

---

5. **The lemon** grows on a small tree, which reaches a height of about twelve feet. In the south of Europe, in Italy, Spain, and Portugal, there are groves of lemon trees. The blossoms grow in clusters. The lemon is egg-shaped, has a thick rind or skin of a pale yellow colour, and soft juicy pulp. It is very sour.

---

6. **The orange tree** is about the size of a small apple tree, and bears sweet-smelling white blossoms. It is found in warm countries—Spain, Malta, West Indies, and California. The soft, juicy pulp, like that of the lemon, is divided into parts, but it is much sweeter. The orange is rounder than the lemon, and of a darker yellow.



## NOTES ON THE COLOURED PICTURES.

1. **The cherry** grows on a large tree, which belongs to the rose family. The flowers or blossoms are white, and are arranged in tufts. The cherry is one of the smallest of stone-fruits. The flesh is soft and pulpy, and when ripe very juicy. Cherries grow in bunches, and each one is at the end of a long stalk. They are usually red, pink and white, or black. The stone contains the kernel or seed.

---

2. **The plum** grows on a large tree, which belongs to the rose family. The flowers or blossoms are white and showy. The plum is larger than the cherry, but less juicy. There are many varieties, which differ greatly in size, colour, and flavour. The plum and the damson are purple, or plum-coloured. The greengage is green. Plums contain stones with kernels inside. Prunes are dried plums.

3. **The apple** grows on a large tree, which belongs to the rose family. It has wide-spreading branches, and pink and white flowers, which grow in clusters. The apple has a firm, hard, juicy pulp, in which are enclosed the seeds, or pips. There are many varieties, and some are highly prized for their rich flavour. The apple is a very wholesome fruit.

4. **The pear** grows on a large tree, which belongs to the rose family. The white flowers grow in bunches. The pulp of the pear is much like that of the apple, but of a different flavour. In shape, the apple is round and the pear is oblong. Pears also contain pips.

---

5. **The lemon** grows on a small tree, which reaches a height of about twelve feet. In the south of Europe, in Italy, Spain, and Portugal, there are groves of lemon trees. The blossoms grow in clusters. The lemon is egg-shaped, has a thick rind or skin of a pale yellow colour, and soft juicy pulp. It is very sour.

6. **The orange tree** is about the size of a small apple tree, and bears sweet-smelling white blossoms. It is found in warm countries—Spain, Malta, West Indies, and California. The soft, juicy pulp, like that of the lemon, is divided into parts, but it is much sweeter. The orange is rounder than the lemon, and of a darker yellow.

## 19. THE LEAVES OF PLANTS.

**Leaves are—**

Thin green blades.

Of many sizes.

Of many shapes.

**Leaves—**

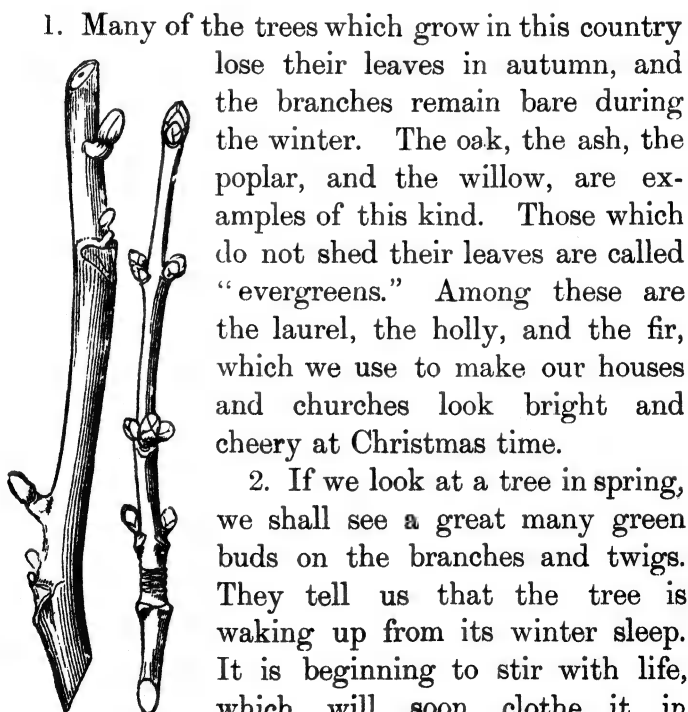
Grow on stems.

Feed plants.

Clothe plants.

**Leaves are—**

Simple, as beech.

Compound, as the  
horse-chestnut.

BUDS.

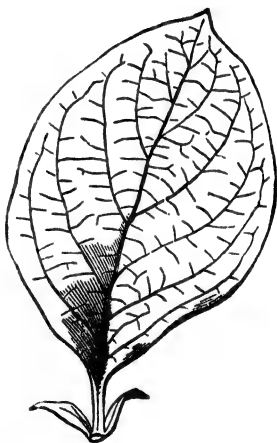
1. Many of the trees which grow in this country lose their leaves in autumn, and the branches remain bare during the winter. The oak, the ash, the poplar, and the willow, are examples of this kind. Those which do not shed their leaves are called "evergreens." Among these are the laurel, the holly, and the fir, which we use to make our houses and churches look bright and cheery at Christmas time.

2. If we look at a tree in spring, we shall see a great many green buds on the branches and twigs. They tell us that the tree is waking up from its winter sleep. It is beginning to stir with life, which will soon clothe it in beauty.

3. These leaf buds, as they are called, grow

larger and larger, until after a time they unfold and the green leaves spread out. Then they begin to do their work, and very important work it is. They are, in fact, the mouths and stomachs of the plants.

4. They have so much to do with the health and growth of a plant that if they become coated with soot and dirt, or are pulled off as fast as they grow, the plant will wither away and die. For though plants grow out of the ground, and obtain root-food of a kind they cannot do without from the soil, they get much more solid food from air and water by means of their leaves.

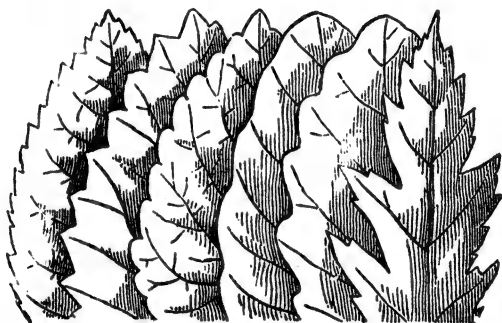


A LEAF.

5. Most leaves are thin and very light, and of some shade of green. Turn one over, and you will see the ribs that branch out from the chief rib, or midrib, in the middle. They are like the ribs in an umbrella, and make the leaf spread out. Some leaves, as those of the india rubber tree, are thick and tough, like leather.

6. Leaves vary so much in form that even those

growing on the same tree are not exactly alike. They have, however, a general appearance by which they may be known as of the same kind. Pull two oak leaves from the same branch, and you will find how much they differ, and yet you can tell at a glance that they are both oak leaves.

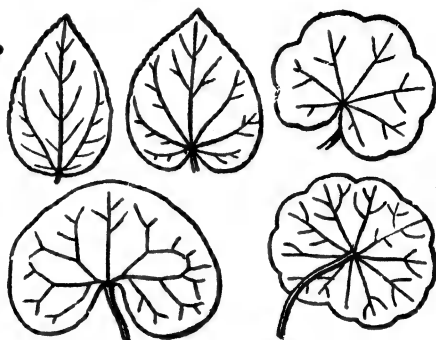


SHAPES OF EDGES OF LEAVES.

7. In the coloured pictures on page 35, we see the leaves of several plants, all of which are quite different in appearance. The most general form, however, is oval or egg-shaped, like the beech, the elm, and the oak.

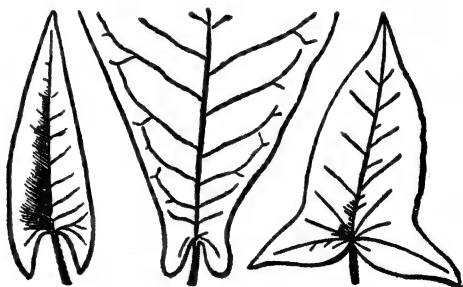
8. We notice that while the beech has a fairly regular or smooth edge, the elm is notched or toothed like a saw, and the oak is indented with bold scallops. The box, too, is regular in form, but the ivy follows the oak in some respects, and the holly is armed with sharp prickles.

9. Then what shall we say about the fern? It is divided into parts, which are again divided into still smaller parts, or leaflets. Fern leaves are exceedingly varied, and are often called fronds. Some of them are very finely cut, or divided, and of great beauty.



SHAPES OF SIMPLE LEAVES.

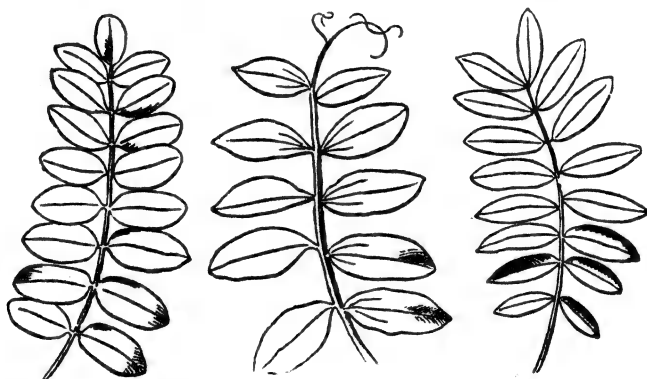
10. In other plants we find leaves like arrow-heads, lances, trowels, fiddles, shields, and hearts. Some spread out like the fingers of our hands or the claws of a bird; while others are long and slender, like large green needles.



SHAPES OF SIMPLE LEAVES.

They also vary in size, from those of the chickweed to those of the rhubarb plant and the palm.

11. On some leaf-stems there is but a single leaf. This is called a simple leaf. All those in the coloured picture are simple leaves, except the fern. The oak and the ivy are the most indented, but as the divisions do not reach the midrib, they are called simple. The divisions are called lobes, a word which means a part.



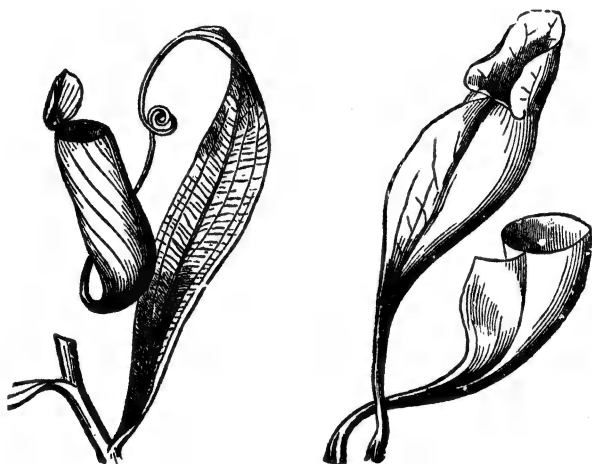
COMPOUND LEAVES.

12. Some plants have leaves made up of smaller leaves, or leaflets. These leaves are called compound. In some instances a compound leaf ends with a single leaflet at the top, in others there is a tendril, and others again end evenly with a pair of leaflets. We see instances of them in the pea, the walnut, the ash, and the horse-chestnut.

13. The number of leaflets into which one compound leaf is divided varies greatly in

different plants. In some instances there are only three, five, or seven leaflets, while in others they are far more numerous. The leaf of the meadow rue is made up of eighty-one leaflets.

14. Among the plants with very curious leaves are the pitcher plants, found in some hot countries. The leaves are like hollow tubes, and in some



PITCHER PLANTS.

instances form a vessel like a pitcher with a lid. They always contain water, in which birds, monkeys, and even men, quench their thirst.

15. Venus's fly trap, the sundew, and the pitcher plant, feed on flesh, like animals. Their leaves are covered with sharp spines, like hairs, which in some cases are tipped with a very sticky,

but clear liquid, shining like dew in the sun.



VENUS'S FLY TRAP.

When an insect alights on the leaf it is held fast in this sticky mass, from which it is unable to escape.

16. In the picture, the trap at the top is open, the one on the right hand side has just caught a fly, and the one on the left hand side is closed. The prisoners caught in this way soon die, and their bodies are dissolved in juices from the leaf. This is sucked in, and

said to help to feed the plant.

**Learn**—LESSON 18, *page* 184.

## 20. STRIKE A LIGHT.

### **Matches are made of—**

Wood, wax, etc.  
Chlorate of potash,  
glue, whiting,  
powdered glass,  
and phosphorus.

### **In Match-making—**

Trees are cut down.  
Wood is split.  
Splints are cut.  
Splints are dipped.  
Boxes are made.

1. How often we say to each other, "Strike a light!" without once thinking of the wonderful invention which enables us in a moment to obtain

a light. Nor do we stop to consider the cost. A box containing one hundred lights may be bought for a farthing.

2. The first important discovery in the art of obtaining a light was the invention of the tinder-box. It consisted of a round tin or iron box, with a socket for a candle on the top, and contained a steel, a piece of flint, and some tinder—linen rag which had been burnt without being set on fire.

3. About sixty years ago the famous lucifer match was invented, by dipping strips of wood in a mixture of phosphorus and sulphur. The name "Lucifer" means light-bearer, and so very popular did these matches become that, although in England they are a thing of the past, the name is given to other kinds of matches.

4. The manufacture of the match now in common use is very interesting, on account of the immense number made, and the low price at which they can be produced.

5. The wood comes chiefly from abroad by many shiploads in the year. Straight, round timber is used, because it is better to work and does not cut up to waste. The planks are planed on both sides and edges, and cut into blocks of about five inches in length—that is, the length of two matches. These blocks are cut into splints of

the size of a match at the rate of 15,616 splints, or twice that number of matches, in a minute.

6. Seeing a van load of splints consisting of 2,000 bundles of 2,000 each—that is, four million splints or eight million matches—we ask how long these will last a factory, and are told that a number of such loads are used every day.

7. The splints are screwed up in frames which contain about 6,000, and both ends are dipped into a liquid which, when rubbed, bursts into a flame. When dry, the matches are cut in the centre, and packed in boxes.

8. In one match factory fifteen hundred persons are engaged inside, and more than twice that number take work home—in all not less than five thousand persons are employed at this establishment. Nor are five thousand pair of hands sufficient to do all the work required, the help of twenty-five steam-engines being also needed. One English firm is said to turn out ten millions of matches daily.

9. Vestas are different from ordinary matches, as thin wax tapers are used instead of wood. Vesuvians, fusees, and flamers, are made by different processes from the ordinary matches. They are made to burn slowly, and to consume only the head. One Birmingham firm manufactures eight miles of wax tapers daily.

10. The boxes are largely made by poor people, who obtain the materials—strips of wood, coloured



A MATCHBOX MAKER WORKING AT HOME.

(From the "*English Illustrated Magazine*.")

paper and sand paper, and printed wrappers—from the factory, and do the work in their own

houses. Thousands of persons of all ages, many of whom could not go out to work, and some of whom are bedridden, are able to earn a little money by making match-boxes.

11. The first matches that would strike a light were sold, in boxes containing fifty, at half a crown a box. Now a box containing twice that number may be bought for a farthing. So cheap are matches that they are kept in a handy place in almost every room, and many persons carry a supply in their pockets.

12. Common matches, that fire when trodden on, are a constant source of mischief. By these means over thirty fires have been caused in London during one year. One fire insurance office puts down its own losses from matches at ten thousand pounds a year. Fires are also caused by mice nibbling at matches, and by careless children playing with them.

13. It would be well if safety matches, that strike only on the box, were more largely used. They are made in the same way as common matches, but instead of putting all the materials required to produce a flame on the match, part is put on the box. Then the matches only strike when they are rubbed on the box.

## 21. HOW WATER TURNS INTO VAPOUR.

### Water—

Changes into vapour, or  
evaporates.

As vapour, passes into  
the air.

### Vapour—

Is a kind of gas.

Is carried off by air.

Is lighter than the air.

Rises in the air.

1. Do you know what happens when we put a kettle of water on the fire ?

If we leave it for a little while, the water will become hot, then it will begin to boil. And if we leave it long enough, we shall find the kettle quite empty.

2. Where has the water gone ? Is it destroyed ?

“No,” you say ; “it is changed into steam.”

3. How do you know this ?

You saw the steam coming out of the spout and from under the lid. This always happens when water boils.

4. But, still, we have not answered the question, Where has the water gone ? In one form or another it must be somewhere. And, though we do not see it, some of the water which was in the kettle is still in the room.

5. That which you call steam is really water vapour—a kind of gas which floats out into the room and mixes with the air. In this form we cannot see it, but it is there, all the same. The

air holds vapour something in the same way as a sponge holds water.

6. You know that a sponge cannot touch water without taking up some of it; and air acts in the same way. And, as it is everywhere present, it is always taking up water in the form of vapour.

7. If you spill some water on the floor, and leave it there for a time, it will disappear. Where will it go? The warm air will turn it into vapour, and away it goes, just as the boiling water went that was in the kettle.

8. Dip your hand into water, and wave it about for a little while. Then you will not have to wipe it. The water will all disappear. The air will carry it off.

9. When clothes are washed, they are hung out in the open air on a line, or placed in front of the fire, to dry. At length we find that the water has all gone, and they are as dry as if they had never been wet.

10. Rain falls on the earth, and the streets and roads become wet and muddy. In a short time after the rain has ceased to fall, they are again dry, and the mud has become dust or dry earth.

11. Sometimes, in the morning, we see the grass in the fields and the leaves on the trees all wet with dew. In an hour or two we look again, and the dew has disappeared.

12. You see that water cannot remain anywhere, on anything, or in any place, without some or all of it being changed into vapour. And when it is so changed, it at once floats away in the air that has taken it up.

13. But why does vapour rise? We know that if we spill water out of a glass it at once falls on the floor. Why does it not float away in the air instead?

Water falls because it is heavier than air; and water vapour—that is, water in the form of vapour—rises because it is lighter than air.

14. Now, this process of water turning into vapour is always going on in all parts of the world. What we see on a small scale with boiling water, drying clothes, and wet roads, is going on on a large scale with springs, rivers, lakes, seas, and oceans, all the year round.

15. The sun and the air are never at rest. They are always busy turning water into vapour and carrying it off. The process is called *evaporation*, for water which passes into vapour is said to *evaporate*.

## NOTES ON THE COLOURED PICTURES.

1. **The grape** grows on a climbing plant called a vine. This plant has a long branching stem, which throws out little twisted stalks called tendrils, by means of which it clings for support. In warm countries the grape-vine grows in the open air, but in this country it is grown in hothouses. Grapes grow in clusters or bunches. They are black or green, very juicy, very sweet, and very refreshing.

---

2. **The gooseberry** grows on a wide-spreading bush, from three to five feet high. The stem is woody, and is protected by sharp prickles. The berries grow separate, and are sometimes hairy and sometimes smooth. They are of a green, red, or yellow colour. They contain very soft, juicy pulp, in which the seeds lie loose.

3. **The raspberry** grows on a bush, with nearly erect stems, covered with numerous small weak prickles. The berries are red, yellow, or white. They are not, however, real berries. Each "berry" is a collection, or cluster, of small stone-fruits.

4. **The strawberry** grows on a plant which creeps on the ground. Each plant throws out runners, which take root in the soil, and grow into new plants. That which we call the berry is not the fruit of the plant. The real fruit is the little seeds which grow on the outside of the berry.

5. **Currants** grow on bushes which have long slender stems. They are often trained against walls, to which they are nailed, to keep them in position. They do not cling like the vine. The berries are red, white, or black, according to the kind of plant. They grow in clusters, or bunches, something like grapes.

6. **The blackberry** grows on a prickly bush, called a bramble. It is the same kind of plant as the raspberry, and the fruit is very similar in appearance. The stem is very slender, and runs along the ground for some distance. It often climbs up other plants, and is seen at the tops of hedges. The "berry," like the raspberry, is a collection of small stone-fruits.



## NOTES ON THE COLOURED PICTURES.

1. **The grape** grows on a climbing plant called a vine. This plant has a long branching stem, which throws out little twisted stalks called tendrils, by means of which it clings for support. In warm countries the grape-vine grows in the open air, but in this country it is grown in hothouses. Grapes grow in clusters or bunches. They are black or green, very juicy, very sweet, and very refreshing.

---

2. **The gooseberry** grows on a wide-spreading bush, from three to five feet high. The stem is woody, and is protected by sharp prickles. The berries grow separate, and are sometimes hairy and sometimes smooth. They are of a green, red, or yellow colour. They contain very soft, juicy pulp, in which the seeds lie loose.

3. **The raspberry** grows on a bush, with nearly erect stems, covered with numerous small weak prickles. The berries are red, yellow, or white. They are not, however, real berries. Each "berry" is a collection, or cluster, of small stone-fruits.

4. **The strawberry** grows on a plant which creeps on the ground. Each plant throws out runners, which take root in the soil, and grow into new plants. That which we call the berry is not the fruit of the plant. The real fruit is the little seeds which grow on the outside of the berry.

5. **Currants** grow on bushes which have long slender stems. They are often trained against walls, to which they are nailed, to keep them in position. They do not cling like the vine. The berries are red, white, or black, according to the kind of plant. They grow in clusters, or bunches, something like grapes.

6. **The blackberry** grows on a prickly bush, called a bramble. It is the same kind of plant as the raspberry, and the fruit is very similar in appearance. The stem is very slender, and runs along the ground for some distance. It often climbs up other plants, and is seen at the tops of hedges. The "berry," like the raspberry, is a collection of small stone-fruits.





## 22. FLOWERS AND BLOSSOMS.

Flowers have—	A Flower has—	Flowers—
Beautiful forms.	A flower-stalk.	Give pleasure.
Bright colours.	A calyx with sepals.	Feed insects.
Sweet perfumes.	A corolla with petals.	Produce fruit.

1. Flowers are to many people the most beautiful parts of plants. We are so fond of them that we grow them in our gardens, plant them in pots and keep them in our houses, and place cut flowers about in our rooms. We also use them as personal ornaments, and wear them on our breasts and in our hair.

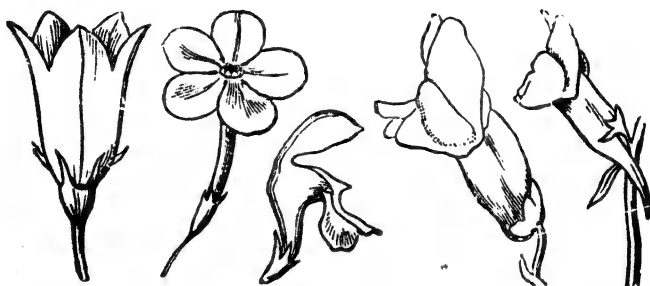
2. Can you tell me why we are so fond of flowers? What is there about them which yields us so much pleasure? It is because they have graceful forms, beautiful colours, and a sweet perfume.

3. We have only to look at the coloured pictures in this book (pages 54 and 71) to see how flowers differ from one another in form and in colour. Though there are more kinds than we can count, there are not two alike. Yet their object is all the same.

4. One flower is shaped like a star, another like a butterfly, another like a cup, another like a bell, another like a purse, another like a funnel, and another like the finger of a glove.

5. In colour, too, there is the same endless variety, and the colour of a flower is even more beautiful than its form. Many flowers are only of one colour, but there are some in which two, three, or more colours appear in the same blossom.

6. The perfume, or scent, of a sweet-smelling flower is one of the most delightful things in the world. In many instances the perfumes of flowers



FORMS OF FLOWERS.

are made into liquids and kept in bottles for use at any time.

7. The habits of flowers are very interesting. Some of them close at night and open again in the morning. The daisy is one of these. Its name is said to mean "day's eye." Some flowers open at the same time every day—in the morning, at noon, in the afternoon, or in the evening.

8. Once a flower clock was made by planting a number of flowers in the same bed. These were

flowers which opened and closed at different times, the one after the other, and so marked the hours as they passed along. We might also make a calendar of flowers to tell the different months.

9. We prize flowers for their beauty, but they have other uses. Many insects live on the sweet juices they find in the flower-cups. The honey-bee flies from flower to flower, gathers the nectar, or juice, makes it into honey, and carries it to its hive. It also collects the pollen, or flower-dust, and makes it into bee-bread.

10. The chief use of flowers, however, is to hold in their cups that which goes to make the seeds of a new plant. When a flower withers and dies, the leaves or petals fall to the ground, but they leave something behind on the flower-stem. It is the seed-vessel, and is called the fruit.

11. The bloom or flower of a plant or tree which bears fruit used for food is called "blossom." We speak of the blossom of an apple tree and the flowers of a rose bush.

12. Now, there are certain names given to the parts of a flower which every boy and girl should know. They look hard words at first sight, but when you have said them over a few times, and know what they mean, they will not give you any trouble.



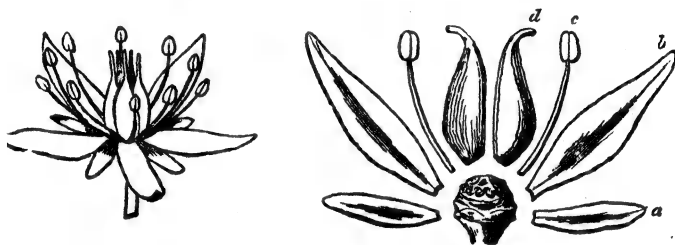
THE ROSE. A FULL DOUBLE FLOWER.

13. A great many flowers are made up of two parts, the flower-cup and the flower-leaves. The flower-cup is set at the top of the flower-stalk, and is called the *calyx*. The flower-leaves inside the flower-cup are called the *corolla*. You see, therefore, that the *corolla* is inside the *calyx*, and they both consist of leaves. The *calyx* leaves are mostly green, and are called *sepals*. The *corolla* leaves are nearly always gay-coloured, and are called *petals*. In the coloured picture on page 143 there is a flower, the meadow saffron, which has the calyx and sepals of the same colour.

14. The stout, green calyx leaves are to protect

the young flower in the bud from injury and cold. The bright corolla leaves, on the other hand, are mainly attractive to the flies and other insects. They often yield honey or sweet perfumes.

15. If we carefully pull the petals off a flower, we shall find some thin, thread-like stems, having yellow knobs at their ends, called *stamens*.



PARTS OF A FLOWER.

(*a*, Sepal; *b*, petal; *c*, stamen; *d*, pistil.)

When these are picked off we shall find in the centre a slender stem with a knob at the top. This stem is called the *style*, and the thicker part at the lower end is called the *pistil*. This becomes the seed-vessel of the plant. When ripe we call it the fruit, and in the fruit we find the seeds.

**Learn**—LESSON 22, page 185.

**23. HOW COAL GAS IS MADE.****Coal Gas is—**

Made in retorts.

A kind of air.

Lighter than  
common air.

Invisible.

Transparent.

Odorous.

Inflammable.

**Coal Gas—**

Gives light.

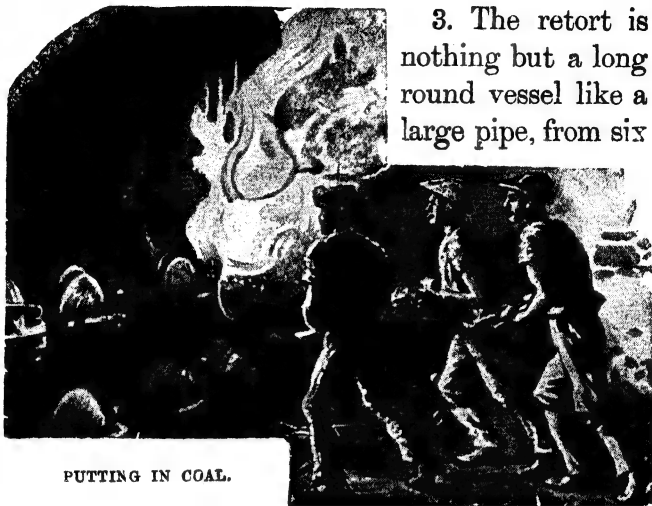
Gives warmth.

Cooks food.

Works engines.

1. How is gas made? In such a simple manner that you may make some for yourself. Coal contains gas. Get a common clay tobacco pipe. Fill the bowl about three-parts full of pounded coal. Cover the top of the bowl with clay. When the clay has become hard, put the bowl of the pipe into the fire, or hold it over a lamp. In a little while you will see smoke coming out of the stem of the pipe. Apply a light to this smoke, and it will burn with a bright flame. The smoke is really coal gas, and if you remove the clay some cinder or coke will be found in the bowl of the pipe.

2. The gas in common use is made in this way by heating coal, only tobacco pipes are not used. At gas-works the coal is heated in large air-tight brick or iron ovens, called retorts. When coal is burned in the open air we get from it smoke, flame, and ashes. When it is burned in a retort, we obtain not only coal gas, but also other useful substances.



PUTTING IN COAL.

3. The retort is nothing but a long round vessel like a large pipe, from six

to eight feet long, and about eighteen inches in breadth. It is tightly closed at one end, and open at the other. The retort has also a closely fitting door, and a pipe fixed at the top for the purposes of carrying off the gas as it is made.

4. The first thing to be done is to separate the gas from the coke. By means of a furnace placed underneath the retort it is made red hot. Then the door is opened, and coal, broken into small pieces, is quickly put in and the door securely closed. The heat of the furnace drives off the gas, which passes through the exit pipe, leaving behind the coke.



DRAWING OUT THE COKE.

5. The gas is then made pure and passed into the gas-holder, or gasometer. This round iron box is in shape like a huge cheese, and often of an immense size. It is open at the bottom, and stands in a huge tank of water, and so hung with chains and weights that it will float and rise as the gas collects in it. As coal gas is lighter than common air, and therefore much lighter than water, the gasometer rises as it fills, and falls when the gas is drawn off for use. Because it is so light, coal gas is used in balloons.

6. Large pipes lead from the gasometer underground through the streets, and smaller pipes branch off from the larger ones and carry the gas to the places where it is needed. At the spot

where it enters our shops and houses, it is caused to pass through a small box, with dials something like a watch face, called a meter, which measures and keeps an account of the gas that is used.

7. In this way those who supply the gas can tell how much has been burned, and we pay for it at the rate of so much per thousand feet. Five feet of gas will give one good light for an hour—a light equal to that which would be given off by about twenty candles—at the cost of less than a farthing per hour.

8. When the gas leaves the meter, it is conducted all over the building by means of small pipes. Gas brackets and chandeliers, which are constructed to give one or more lights, according to the size of the room to be lighted, are attached to the walls or suspended from the ceiling.

9. The pipes pass through the brackets and chandeliers, and at the ends of the pipes burners are fixed. They are of various kinds. The best burners are so constructed as to prevent the escape of unburnt gas, and to give the greatest light that can be obtained from the amount of gas used.

10. Besides being our chief source of light at the present time, coal gas is often used for heating purposes—to warm rooms, in various manufactures, and for cooking. It is cleaner than a coal

fire, thoroughly under command, and may be lighted or put out at a moment's notice.

11. When gas escapes and collects in any closed-in place, where it mixes with common air, as in a room or cupboard, it should not be approached with a light, or an explosion may be the result. We know something of the tremendous force it exerts when we see it wreck buildings and destroy life. But this tremendous power has now been turned to a useful purpose, and gas-engines, requiring neither fire, boiler, nor steam, are driven by a series of explosions of a mixture of gas and air.

12. When there is a smell of gas in a room, no one should go near the place with a light. The only wise and safe thing to do is to open the windows and doors. Then the gas, in trying to spread out and fill the greater space, will escape, and fresh air will enter the room to take its place. It is this kind of gas which is given off by coal in mines, and is called by miners coal damp. To prevent explosions, miners use safety lamps, which do not allow the flame to come in contact with the gas.

13. From the waste product which is separated from the gas in making it pure we get an article called ammonia, which is used in medicine; and coal tar, a substance once regarded as so dirty and useless that it was destroyed as soon as

possible, but now known to be a perfect mine of wealth.

14. From coal tar we get a spirit called naphtha, used to burn in lamps and for other purposes ; benzoline, a substance used for removing grease from cloth, kid gloves, and other articles of clothing ; aniline, from which are produced the beautiful colours known as mauve, magenta, rosaline, and a variety of shades of blue, violet, green, orange, and crimson ; and, last of all, a black solid substance called asphalt.

Learn—LESSON 23, page 186.

## 24. WHY A BALLOON ASCENDS.

### Balloons are—

Bags of paper or silk.	Light.
Filled with hot air or	Ascend quickly.
coal gas.	Float easily.

### Balloons—

Have light cars.
Carry persons
and letters.

1. Get a basin, some warm water, and a bit of soap. Stir the water with a clean pipe until it forms a lather, fill the bowl of the pipe with lather, and blow through the stem. Bubbles will form on the bowl and float away in the air.

2. These soap bubbles are really small balloons. They consist of a ball of air contained in a thin covering of soap and water. This covering is so

thin that a touch will break it and cause the bubble to burst, but while it floats it is strong enough to hold the air.

3. Now, what is it that makes the bubble rise and float in the air? And why is it that the bubble floats only a little way and then comes down and falls on the ground?

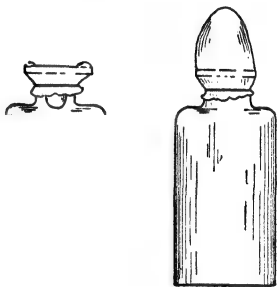
4. The reason is this: the air in the bubble is warmer than the air outside the bubble. It is warmer because it has just come out of your warm lungs. The warm water does not cool it, and so when the bubble is formed it at once rises. Why? Because warm air is lighter than cool air. A soap bubble is therefore a ball of warm air floating in cool air.

5. It does not, however, remain warm very long. The outer air cools it. The soap-and-water balloon will then be filled with cool air, and instead of rising it will begin to fall, because of the weight of the covering.

6. If you use cold water, it will cool the air from your lungs, and if the room is warm the bubble will not rise as well as in cold air. The greater the difference there is in warmth between the air in the bubble and the air around it, the better will the bubble ascend. Warm, light air goes up quickly in heavy, cold air for the same reason that any light thing, like cork, rises in water.

7. But what do we mean by light air and heavy air? How can air change its weight, and be at one time heavy and at another time light? Air is heavier or lighter according to the space it fills. If the particles lie closer together, the air becomes heavier; if they spread out the air becomes lighter. Dry air and warm air are lighter than damp air and cold air.

8. If we get an "empty" bottle, and, leaving out the cork, tie a small indiarubber balloon over the mouth, we may prove that warm air fills up a greater space than cold air, and therefore it is lighter. We can do this by warming the bottle. This will cause the air it contains to become warm.



9. Then the air will expand, or spread out, and fill the balloon tied over the bottle mouth just as if we had blown air into it. The cold air filled the bottle only, but the same air warmed fills the bottle and forces its way into the balloon as well.

10. Now you will be able to understand why a balloon ascends. Because it is so light, you will say; but what makes it light? The stuff of

which it is made—the paper or the silk—are not as light as the air, and will not rise of themselves. It must therefore be filled with something to make it light.

11. If you make or buy a small paper balloon and hold the open end over something burning—a lamp, lighted gas, or a small fire—the air inside the balloon will become hot. Then it will rise and float away, because, like the soap-bubble, it is lighter than the air outside.

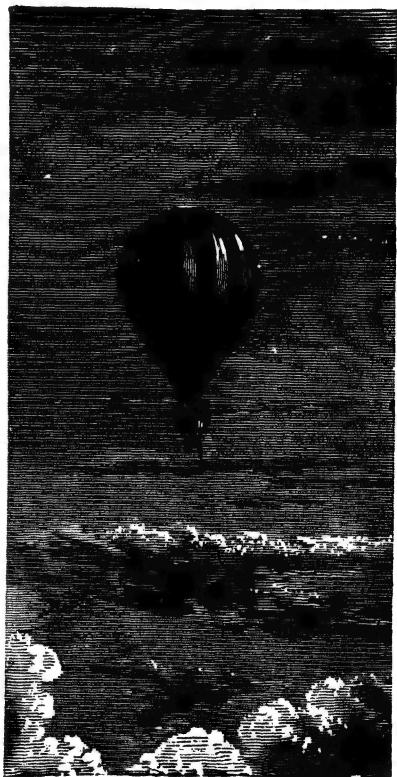
12. How long will a balloon of this kind remain up? Only for a short time. As soon as the cold air outside cools the air inside, the balloon will fall to the ground. Filled with cold air, the balloon is not as light as the outside air, because the stuff of which it is made is heavier.

13. The first balloons made were called fire balloons, because they were filled with hot air by means of fires burning beneath them. Now balloons are filled with hydrogen or common coal-gas, like that which we burn in our houses. It is lighter than cold air, much easier to use than hot air, and a balloon filled with it will float until the gas escapes.

14. Large balloons are made of silk or some other very light material, and covered with a thin indiarubber varnish to make them air-tight. Over the balloon is stretched a network of cords,

from which hangs a basket-work car, in which persons and things may be carried through the air.

15. Bags of sand are carried in the car to steady it in its flight. If the balloon does not rise fast enough, it can be lightened by throwing out some of the sand bags. When those in the car wish to descend, they pull a cord which opens a little door, called a valve, in the top of the balloon. Some of the gas then escapes at the top, and air rushes in at the bottom to take its place. Thus the balloon becomes heavier, and then begins to descend.



A BALLOON IN MID AIR.

16. When the balloon is near the ground a kind

of anchor fastened at the end of a long rope, called a grappling iron, is thrown out to catch hold of something and anchor the balloon. This prevents it from being tossed about on the ground, and keeps it still while the people get out.

17. Many ascents have been made in balloons, and a height of between seven and eight miles has been reached. Persons have escaped in them from towns surrounded by soldiers in time of war, and letters have been carried by them. But until a perfect plan of guiding them has been found out, they cannot be used with certainty.

18. As balloons float in the air, they must, to a large extent, travel the way the wind blows, and sometimes it blows in one direction near the earth, and in quite another direction high up in the air. A person may therefore set out to go in a certain direction and be carried an entirely opposite course. Balloons have been known to travel faster than express trains.

19. During four months, while the Germans surrounded Paris in 1870, sixty-six balloons left that city, conveying over three millions of letters and one hundred and sixty persons. One of these balloons was carried to Norway, two were lost at sea, and three were captured by the enemy.





## NOTES ON THE COLOURED PICTURES.

1. **Wheat** is one of the most valuable of all our corn plants. It is a kind of grass which bears large seeds, called grains of corn. When ripe it turns yellow. The stalk or stem is hollow, like a pipe, with joints. It grows to the height of about four feet. The ear is the cluster of seeds, or grains of corn, which grow round the top of the stem—one ear on each stem. The grain or seed is covered with a thin shell or husk—one grain in each husk. The grain is oval, hard, brown outside, and white inside. It is ground into flour to make bread.

2. **The flax plant** grows as a herb and as a small shrub. The common flax is about 2 feet high. It has a straight, slender stem, which branches out at the top. It bears narrow, pointed leaves, and pale blue flowers. The threads, or fibres, are made into linen.

3. **Barley** is a corn plant, something like wheat in appearance. It has a straight, hollow, jointed stem, which bears an ear at the top. The ear is a cluster of seeds, or grains, which grow round the stem. From the husks long, stiff threads grow out, called the beard. Barley is used in the form of grain, called pearl barley, and is made into malt.

4. **Cotton** is a soft, white, downy substance, like fine wool. The cotton plant is a shrub, which grows in hot countries, and bears a yellow flower. The seed-pod, or boll, is the fruit, and contains the seeds, wrapped up in the fine, white down.

5. **Oats**, or **oat**, is a corn plant. The grains grow in husks at the ends of fine threads, and form a bunch at the top of the stalk. Oatmeal, that is, the meal of oats, is made by grinding the grain to powder. It is made into porridge and oatmeal cake.

6. **The hop** is a twining shrub. In hop-gardens poles are placed support the plants. The flowers grow inside large scale-like leaves, which form heads, something like fir cones. These leaves contain a bitter taste which is used to impart flavour to beer.

## 25. FRUITS AND SEEDS.

<b>Fruit—</b>	<b>Some fruits are—</b>	<b>Kinds of fruit—</b>
Is the seed-vessel.	Wholesome.	Apple, pear.
Ripens after the	Eaten raw.	Plum, cherry.
flower.	Cooked for food.	Orange, lemon.

1. The fruit of a plant is the seed-vessel or seed-holder. It appears at the end of the flower-stalk when the blossoms or flowers fade away and fall off. By the time that the seeds in the vessel are ripe the flower has changed into the fruit. Only the parts of the flower that have done their work, and are no longer needed, drop off the plant.

2. Some kinds of fruit are much larger than is needed to hold the seeds. These are mostly sweet, juicy, and wholesome, and we only give them the name of fruit because we use them for food. Other kinds, which are just as much fruit, are only large enough to hold the seeds, and are neither pleasant to the taste nor wholesome for us to eat.

3. When the blossom of the apple or the pear falls to the ground, a small green knob is seen in its place. This knob grows larger and larger, until it becomes a full-grown apple or pear. And, if allowed to remain on the tree, it will ripen in the sun.

4. If we cut an apple or a pear across, we shall find that it has a firm, hardish, juicy pulp or flesh, which is very wholesome and pleasant to eat. In the middle of the pulp there is a kind of case, called the core. This contains five small chambers or cells, in which are little brown pips. They are the seeds, and the fruit has grown round them to protect them from harm until they were ripe. When you learn more about plants, you will find that the flesh of apples and pears is simply a swollen calyx-tube, and, strictly speaking, not a fruit at all.



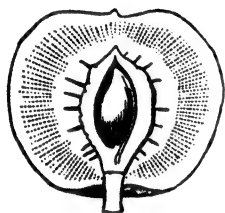
FLESHY FRUIT,  
OR POME.

5. The apple is round like a ball, but somewhat flat at the top and bottom. The pear is oblong, and tapers at the end next to the stem. Both of these fruits are eaten raw and cooked in various ways. Apples are more wholesome than pears. A drink called cider is made from apple-juice, and a drink called perry is made from the juice of the pear. Apples and pears are called "pomes."

6. Ripe fruit is refreshing and very enjoyable almost at all times, and it is of great use in helping to keep our blood pure and in a healthy state. We should, however, be careful not to eat

unripe fruit, unless it is cooked. Serious illness may be brought on by want of care in eating fruit.

7. Plums and cherries are another kind of fruit. They have a much softer pulp than the apple, and contain a seed, or kernel, inside a hard case, called a stone. On account of this, they are known as stone fruits. Like apples and pears, they grow on large trees, all of which belong to the same family as the rose.



STONE-FRUIT, OR  
DRUPE.

8. The plum is a juicy fruit. There are several kinds, with a green, purple, or yellow skin. Some kinds have separate names, and are not spoken of as plums. Among these are the damson and the greengage. A certain kind of dried plum is called a prune.

9. Cherries are smaller than plums, and hang to the branches of trees by much longer stalks. They are among the smallest of stone fruits, and have such a beautiful red skin that we often speak of things being "as red as a cherry."

10. Stone fruits are not as wholesome as apples and pears, and, if eaten when over-ripe or unripe, they often do much harm, and cause illnesses. Care should be taken not to swallow the stones,

as the stomach cannot digest them, and they may do serious injury. Stone fruits are known as "drupes."

11. Oranges and lemons have thick, rough, yellow skins, and soft juicy pulp divided into compartments. They are really a kind of berry with a thick rind. The seeds are white, and lie in the middle of the fruit. They grow on small trees in warm countries—Sicily, Malta, Spain, and the West Indies.

12. The orange is rounder than the lemon, and like a ball with the top and bottom flattened. It is of a deeper yellow than the lemon, and, when ripe, very sweet. It is mostly eaten raw, or made into marmalade.

13. The lemon is longer than the orange, and much sourer. It is chiefly used in making a drink called lemonade, and in flavouring other drinks. Lemon-juice is used as a medicine in cases of fever and scurvy.

14. There are many other kinds of fruit, though some of them are not called fruits. We shall read about some in the following lessons.

**Learn**—LESSON 25, *page* 186.

## 26. MORE FRUITS AND SEEDS.

### Kinds of fruit—

Grapes grow on vines.

Gooseberries grow on prickly bushes.

Raspberries grow on prickly canes.

Currants grow on bushes.

Blackberries grow on brambles.

Strawberries grow on plants called "runners."

1. Among the smaller soft fruits there are many kinds of berries, which grow on bushes and climbing plants. These fruits have very soft, juicy pulp, in which the seeds are embedded. In some of them the pulp is so liquid that it runs out as soon as the skin is broken.

2. The grape is the most valuable of the berries, because it is so very wholesome as a food, and on account of its rich, delicate flavour. It requires a warm climate, and in those countries where it will grow it is carefully cultivated in vine gardens, called vineyards, and gives employment to a large number of persons.

3. The hilly countries south of the Caspian Sea are said to be the true home of the vine, on which this famous fruit grows, but at the present time it is cultivated very largely in France, Spain, Portugal, and Germany, and, indeed, all along the shores of the Mediterranean Sea.

4. In England and other colder countries the

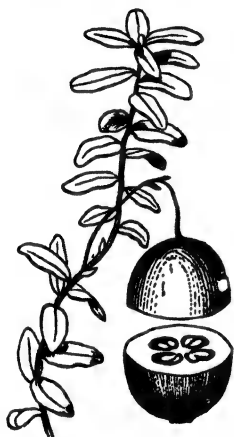
vine is grown in hothouses, and the grapes ripened in this way are so rich and well-flavoured that they often command a very high price. At Hampton Court Palace there is a famous vine more than one hundred years old. In one season it produces over two thousand bunches of grapes, weighing nearly a ton.

5. The vine is a climbing plant, which requires support to enable it to rise from the ground. The stem is tough, woody, rough, and wrinkled, and climbs by means of tendrils. These are small stems, which grow out and curl round any support, something like a hook or bent finger.

6. The grapes grow in large bunches or clusters, and are green, purple, or black when ripe. The skin is hard and tough, and the pulp is very soft and sweet. The seeds inside the pulp are stony and bitter to the taste. Some kinds of grapes have no seeds. Sultanas, raisins, and currants from Greece, are the dried berries of seedless grape vines.

7. Though largely used as a food in the countries where they are grown in the open air, and also a favourite fruit in this country, grapes are of most value for making wine. This is the chief industry in some parts of Europe. Some kinds of grapes are dried, and called raisins and currants. They are used in making cakes and puddings.

8. The gooseberry is most like the grape in size and appearance, but it is a much commoner fruit, and grows on a different kind of plant. A gooseberry bush grows to a height of several feet. It has a woody stem, which branches out on every side, and bears not only leaves and fruit, but also sharp prickles.



A BERRY.

9. It grows in this country, and is found abundantly in almost every garden. The berries are red, green, and yellow, and grow separate on the branch, not in clusters like the grape. They are somewhat egg-shaped, and contain very soft pulp, which surrounds the seeds. They are very largely used, and eaten both raw and cooked. As they are often plentiful and cheap, they are among the best known of our fruits.

10. Currants are small, grape-like berries, which grow on bushes of quite a different kind from the gooseberry bush. Instead of branching out from one stem, each plant consists of a number of separate stems, all of which spring from the root. Currants, red, white, and black, grow in bunches or clusters.

11. The raspberry grows on a plant with nearly erect stems or canes, which are covered with weak prickles. The fruit is red, yellow, or white. It is not a real berry, all the parts of which are enclosed in one skin, like the gooseberry, but a mass or cluster of small stone fruits, each of which contains a seed.

12. The blackberry, which grows wild on a prickly shrub called the bramble, is a fruit of the same kind as the raspberry. When ripe it is of a deep glossy black, and very sweet and pleasant to the taste. The seeds are contained in the little round berries or fruits of which each "berry" is composed.

13. The strawberry is quite a different kind of fruit from the berries we have been considering. The plant creeps along the ground and throws out runners, which take root and form new plants. The so-called berry is really the end of the flower stalk grown very large, and is not a seed-vessel at all. The pulp is much firmer and less juicy than the other berries, and the seeds grow on the outside. It is a very choice fruit, much hardier than the grape, and more largely cultivated in England. Every season many tons of strawberries are sent to the London markets.

## 27. DRY FRUITS.

**Dry fruits—**

Have no pulp.  
Grow in pods.  
Grow in shells.

**Kinds of dry fruits—**

Peas.	Wheat.	Rice.
Beans.	Oats.	Maize.
Lentils.	Barley.	Nuts.

1. Dry fruits are those which ripen without forming flesh or pulp. These are of two kinds : those in which the seed-vessels split or burst open to discharge the seeds, such as the pea and the bean ; and those which remain closed, and retain the seeds until they grow, such as grains and nuts.

2. When we speak about fruits, we do not think of peas, beans, and lentils, which grow in pods. The reason is that the pods, or seed-vessels, are thrown away or given to animals to eat, and we use the seeds themselves for food. It is well, however, to bear in mind that pea-pods are as much fruit as apples and oranges are.

3. The pea is a very common climbing plant, which is grown in all parts of the country, both in gardens and fields. It bears long, narrow, green pods or shells, each of which contains a number of round seeds called peas.

4. If we take a pea and strip off the outer skin, we shall find that it consists of two halves. Each half is really a leaf stored with food for the use of the young plant when it begins to grow. If we

look carefully, we may see the young plant lying between the two halves.

5. The bean belongs to the same order of plants as the pea. It also grows in a pod, green outside and white and woolly within. If we treat the bean in the same way as the pea, we shall see that between its two halves lies a tiny plant.

6. There are many kinds of beans, some of which have soft, upright stems, able to support themselves. Others, such as the scarlet-runner, or kidney-bean, are climbers, and require support.

7. Lentils are a kind of tares, or vetch, something like the little purple vetch found in our cornfields. It is only a small plant, and requires support. It bears short, thin pods, which contain hard, dry seeds.

8. Peas, beans, and lentils are called pulse—a name given to seeds which grow in pods and are good for food. They are all very nourishing, and are worth more to supply the wants of the body than any other kinds of vegetables. They contain a substance more of the nature of meat than bread, and should be largely used by those who are engaged in hard work.

9. Now we come to another form of dry fruit, which is called grain. It grows in ears, on a kind of grass, having a hollow stalk, called straw. This is the corn plant, of which there are various

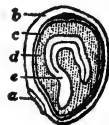
**HARVEST TIME.**

(From the "*English Illustrated Magazine*.")

kiuds. The chief in the British Isles are wheat, oats, barley, and rice.

10. In corn plants the blossoms or flowers are green until they turn yellow, and because of their colour we do not think of them as flowers. The grains, which take the places of the flowers in the ears, are the fruit. Each grain is a separate fruit, and contains a seed, just as a cherry is a fruit and contains a seed.

11. There is, however, this difference between grain and some other fruits. The thin seed-vessel, or case, fits closely to the whole surface of the seed. It is not removed when the seed is sown, but is planted just as it comes from the ear. In the picture we see a seed, magnified, or drawn larger than it really is, and cut through lengthwise to show the different parts—*a*, the scar; *b*, the outer coat; *c*, the inner coat; *d*, the albumen; and *e*, the young plant.



GRAIN.

12. If we compare the ears of the different kinds of corn, we shall find that they are not alike. An ear of wheat has the grains lying close and compact at the head of the stem. Barley is something like wheat, with a long beard. Oats and rice ears form branches, with the grains at the ends of fine stalks, like threads.

13. Grain forms the most important food for men and animals, and one kind or another is used in almost every part of the world. Its chief value is in making bread, which in many countries is the chief article of food, and is often called "the staff of life." In this country wheat is the chief grain crop; in the United States of America maize or Indian corn is the chief; in India and China rice is the most abundant.

14. Another form of dry fruit is seen in nuts of various kinds, some of which are used for food. A nut is fruit, which consists of a seed, or kernel, contained in a hard covering, or shell. Among those used for food are hazel-nuts, walnuts, chestnuts, Brazil nuts, and cocoanuts. Of these the hazel-nut is the smallest, and the cocoanut is the largest.

15. Hazel - nuts, beechnuts, chestnuts, and acorns, have each but one seed in a shell. The shell of the walnut is in two parts, and the kernels are wrinkled. The chestnut has three nuts, each in separate shells, contained in one husk. The nut is surrounded by a cup, which, however, is no part of the fruit. In the acorn the cup is scaly, in the hazel it is a leafy covering, and in the beech and the chestnut it is a kind of bur, or prickly head.



ACORN.

16. The cocoanut, which grows on a kind of palm tree in hot countries, is in many respects different from other nuts. When obtained from the tree it has an outer coat, then a fibrous covering, then a shell, and then the kernel, which contains the milk. The whole fruit is therefore much larger than when it appears in our shop windows.

17. The new plant is contained in the white

kernel, and lies near the end of the nut where the two holes are seen. When a nut is planted, the young tree grows out through one of these holes. But what is the milk for? It is there to nourish the young plant when it begins to grow, and keep it alive until it is able to support itself from the soil and the air.

18. A cocoanut will sometimes float for weeks in the sea, until it is cast up on a coral reef or island, where it roots and grows. It is one of the very few important food plants that can exist with its roots washed by seawater.

19. The pine, which bears leaves like needles, has a fruit called a cone, which in some kinds are six to eight inches in length. The outer leaves are arranged in scales, the one overlapping the other. A cone is called a multiple fruit. It is really a collection of seeds produced from a single flower. Some kinds of cone seeds are eaten in the countries where they grow.



CONF.

## NOTES ON THE COLOURED PICTURES.

1. **The foxglove** bears large bell-shaped flowers, of a light purple colour, with dark spots inside. The name is said to mean "folk's glove," or "fairy's glove," and refers to the flowers, which are like the fingers of a glove. The leaves are oval, wrinkled, and hairy. The plant is highly poisonous.

2. **The monkshood**, or aconite, has glossy, handshaped leaves of five or seven divisions. The blue flowers are like the cowl, or hood, worn by monks. Every part of this plant is poisonous.

3. **The meadow saffron** bears large, flat, spear-shaped leaves. The flowers, or blossoms, are of a light purple colour, and both the flower-cup and the flower-leaves are of the same colour. The whole plant is highly poisonous.

4. **The deadly nightshade** has large, egg-shaped leaves, and dull purple, bell-shaped flowers. The berries are at first green, and then become bright, shining black, something like cherries in appearance, but without stones. The juice of the berries is called belladonna. Every part of this plant is highly poisonous.

5. **The thornapple** bears white, funnel-shaped blossoms. The fruit, which gives its name to the plant, has an outer covering of thorns, and contains black seeds. The plant has a strong, overpowering smell, and is very poisonous.

6. **The yew** is an evergreen tree, which bears needle-shaped leaves. The fruit, or berries, are red when ripe, and have a bare, nut-like seed standing out of the open end. Both the leaves and the seeds are poisonous.

7. **The henbane** has a hairy stem and leaves. The flowers are of dull yellow or cream colour, marked with lines of purple. The flowers are in the form of a funnel or trumpet. The plant is highly poisonous.

8. **The bittersweet** is a climbing plant. It has heart-shaped leaves and wheel-shaped purple flowers, with a yellow centre. The fruit is a small red berry, and is poisonous.





## 28. THE LIFEBOAT.

<b>Lifeboats are—</b>	<b>Lifeboats are—</b>	<b>Lifeboats have—</b>
Kept on the sea coast.	Very buoyant.	Air-chambers
Save life from shipwreck.	Unsinkable.	or watertight compartments.
	Self-righting.	Iron keels.
	Self-discharging.	

1. Imagine yourself at one of our seaside towns in the middle of winter. The waves thunder on the beach with great force, and only a few boatmen stand under the shelter of a wall talking about the weather. The short wintry day draws to a close, and darkness settles down on the town. Out at sea the lightship pitches and tosses, sending its cheerful light across the black waters.

2. Suddenly the lookout on the lightship sees a light flash out in the gloom, faint at first, then brighter, then again dimmed by the flying spray. He knows the meaning of the signal. It is an appeal for help from the crew of a vessel which has struck on the fatal sandbank, and who, knowing that there is a lifeboat on shore, have lighted a flare as a signal of distress. Brightly it burns till it is put out by an enormous sea breaking over the doomed vessel.

3. At the same moment the boom of the lightship gun is heard, and the flash of a rocket follows the report. Then all is dark again, till another

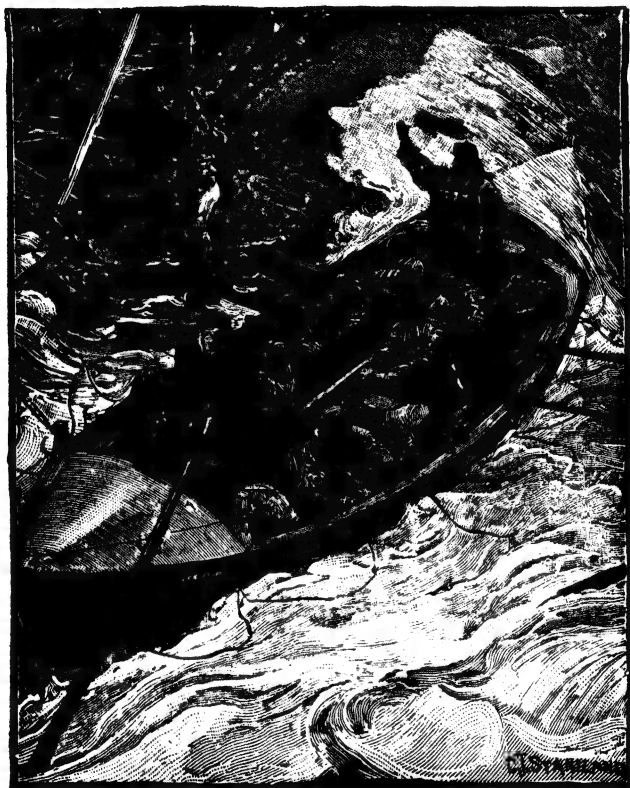
flash from the shore announces that the signals have been seen.

4. Meanwhile the town has been aroused from sleep by the ringing of the bell at the lifeboat house, and men are hastening along with all speed. The lifeboat is run out on its carriage, which is backed into the surf by willing hands. The crew scramble into their places, wrapped in their oil-skins and with cork life-belts.

5. The coxswain takes his place at the stern, and watches for a favourable moment to launch the boat. The lifeboat crew sit ready with the oars waiting for the word of command. At length the coxswain gives the order, the boatmen bend to the oars, and away goes the gallant little vessel on its errand of mercy, followed by the cheers and prayers of those on shore. Though frequently enveloped by the mountainous waves, the lifeboat shakes herself clear, and bravely proceeds to the wreck, which is reached after a hard struggle.

6. The exhausted seamen, almost dead with fatigue and exposure, are taken on board, and the boat's head is pointed to the shore, where their arrival is awaited by an anxious crowd. The return voyage is accomplished with safety, and rescued and rescuers step ashore amid the ringing cheers of the crowd.

7. Lifeboats are so made that they will not sink. They keep afloat even when they are full



TO THE RESCUE.

(From the "*English Illustrated Magazine*.")

of water and crowded with persons. They are really capable of supporting more than they will

hold, as they have air-chambers, or watertight compartments, round the sides of the boat, under the seats, and at the bow and the stern.

8. These air-chambers make the boats lighter than the water, and things which are lighter than water cannot sink. It is the same with cork, which is used in making life-belts; and bladders, which are used by persons learning to swim.

9. Lifeboats are sometimes upset or turned upside down by the rough waves. But they do not remain in this position. They at once right themselves, for they cannot remain bottom up. Self-righting is obtained by means of a heavy iron keel, which runs along the bottom.

10. Lifeboats can also discharge any water which may be shipped. This is done by means of a number of large open tubes, so arranged that they drain the boat, without allowing the water to pass upwards.

11. More than three hundred lifeboats are stationed on various parts of our shores. They are kept in houses on the beach, ready for use at a moment's notice. A transporting carriage—a framework on four wheels—quickly conveys the boat to any part of the coast where it may be needed. A lifeboat and a boathouse together cost about one thousand pounds.

## 29. THE GOLDEN FLEECE.

Wool grows on—	Wool is—	Wool comes from—
Sheep.	Soft and white.	Australia.
Alpacas.	Warm and light.	New Zealand.
Cashmere goats.	Fibrous and porous.	South Africa.
Angora goats.	Flexible and elastic.	

1. In that part of Yorkshire known as the West Riding, woollen mills are at work in almost every town. and employ hundreds of thousands of persons. Leeds and Bradford are the centre of the woollen trade.

2. Cotton is now largely used as clothing material, but there was a time when wool was the chief material used for clothing, both in England and in many other countries.

3. Hundreds of years ago, before cotton was made into garments, men knew how to make woollen cloth. The ancient Britons had some knowledge of this industry, and the Romans set up a woollen mill at Winchester.

4. Five hundred years ago English sheep produced all the best wool. Then Norfolk was the centre of the woollen trade, and the chief market was held at Stourbridge. The annual cloth fair in that town was visited by traders from other countries.

5. When men found out how to make better

machines for spinning and weaving, and could do the work by steam instead of by hand, more wool was wanted than our sheep could supply.

6. At first we received wool from Spain and Germany. Then there was a cry for more. Other countries began to send wool from their sheep, until it came from all parts of the world.

7. At the present time we receive large quantities of wool from Australia, New Zealand, and South Africa. In these countries there are large sheep farms, on which millions of sheep are reared, chiefly for the sake of their wool.

8. As these countries are parts of the British Empire, the woollen industry in all its branches, wool-growing abroad and cloth-making at home, is to a large extent in our own hands.

9. Australia is sometimes called the "Land of the Golden Fleece," because the rearing of sheep has been one of the chief sources of wealth in the island continent. It has been worth more than all the gold mines.

10. The sheep is not a native of Australia. When the first settlers went there, they found that the chief animal was the kangaroo; now it is the sheep. These useful animals were taken in ships from this country, and since then they have increased rapidly. In 1890 there were eighty millions.

11. Wool is the soft fleecy covering of the sheep and of some other animals. It becomes longer and thicker as winter approaches, to protect the animal from the cold. In spring it is cut off, and sent to the mills to be made into cloth.

12. Wool is soft, light, warm, porous, and fibrous. It makes the warmest and most healthy clothing. While cotton is largely used in hot countries, wool still has the first place in cold countries.

---

**Learn**—LESSON 29, *page 188.*

### 30. HOW VAPOUR TURNS INTO WATER.

#### **Vapour—**

Changes into water, or  
condenses.

Is condensed by cold.

#### **Water—**

Is heavier than the air.

Passes out of the air.

Falls as rain.

1. We have seen that water turns into vapour and is carried off by the air. But what becomes of the water-vapour?

It just stays in the air until it is turned back into water, and then it does what all water does which is not contained in a vessel or shut up in some way: it falls to the ground.

2. Heat changes water into vapour. It may be the heat of the fire or the heat of the sun;

both act in the same way. Cold undoes what heat has done, and turns the vapour back again into water.

3. Sometimes on a cold night, when the doors and the windows are all closed, and there is a big fire burning in the room, and we are as cosy as we can be, we see little streams of water running down the window panes on the inside.

4. Now, where has that water come from ?

Out of the air in the room. For you must remember that the air is never so dry as not to contain some water in the form of vapour.

5. Then, what has happened in the room to turn the vapour into water ?

The air outside is colder than the air inside, and the glass in the window is colder than the rest of the room, made so by the cold air. When the warm air comes in contact with the cold glass, the vapour it contains becomes chilled and turns back into water, and settles on the window pane.

6. Now, this is what happens on a large scale to the vapour which is for ever rising in the air. How high it will go depends on how warm the air is. The warmer the air the higher the vapour will rise, because it will remain in the form of vapour.

7. The further the warm air gets from the earth, the colder it becomes. You know that

very high mountains are covered with snow all the year round. The plants at their foot may be burnt up by the heat of the sun, but the snow on their summit remains unmelted.

8. Men, who have gone up to a great height in balloons, tell us that the cold high up above the earth is most intense, even in the middle of summer.

9. When the warm air carrying the vapour gets into these cold regions, it begins to cool, and the vapour begins to change again into water in the form of tiny drops. As vapour it spreads through the air, but as water it comes together and forms masses in the sky, called clouds.

10. Some of the clouds that we can see are about ten miles above our heads. But as the drops of which they are made become larger and heavier, the clouds descend much nearer the earth. Then, when the air can no longer retain the moisture, down it falls in large drops, and we say, "It rains."

11. So you see we get all the water back again. We cannot prevent it from going off in vapour, and we must take it back when it changes again into water and falls as rain.

12. But why should all this take place? Why not let the water remain where it is on the earth, and not have it for ever rising only to fall again?

13. This is the plan by which the earth is watered and the streams are constantly supplied. Some of the water, which falls in the middle of England, may have come thousands of miles from the great oceans in the hottest parts of the earth.

14. There the burning sun turns large quantities of water into vapour. The air in the state of wind carries it long distances, and often it falls again far from the place where it first rose into the air.

15. I told you that the process of turning water into vapour is called *evaporation*. Now I want you to learn another big word. The process of turning vapour back again into water is called *condensation*. Perhaps these long words may be easier for you to remember if I tell you that *evaporation* means to spread or to scatter, and *condensation* means to come together.

16. When water *evaporates*, it spreads or scatters through the air as vapour. When vapour *condenses*, it comes together again and forms drops of water.

**Learn**—LESSON 30, page 188.

**31. PLANTS WHICH POISON.**

Foxglove.	Blue monk's-hood.	Spotted hartwort.
Thornapple.	Meadow saffron.	Four-leaved true-
Bittersweet.	Deadly nightshade.	love.
Henbane.	Buttercup.	Darnel.
Yew.	Laurel.	Some mushrooms.

1. Sometimes, when children are walking by the wayside or rambling through woods, they see pretty berries growing on plants. They do not know the names of the berries ; but because they look nice, and are something like the currants which grow in gardens, the children pluck them and eat them.

2. Soon afterwards the children are taken ill ; they become sick and very sleepy, and lose the power of their limbs. The doctor is sent for, and he at once asks what they have been eating. Why ? Because he sees that in some way they have taken poison, and the quicker he can find out what it is, the better can he tell what to do.

3. He knows that there is not a moment to be lost. If something is not done very quickly to get the poison out of the stomach, it will pass into the blood, and may cause death in a short time. Many persons have lost their lives in this

way, in spite of all that the doctor and their friends could do for them.

4. Now, poison is a substance which, when taken into the body in any way, can destroy life. And there are some plants which contain such substances. Among them are plants which bear pretty flowers and nice-looking berries, which look good for food, as you may see in the coloured picture on page 143.

5. The foxglove is a tall plant, which grows wild, and bears large bell-shaped flowers of a purple colour, with spots on the inside. The name "foxglove" is said to mean "folk's" or "fairy's glove," and was given to it because each flower looks like the finger of a glove. The plant is highly poisonous, and no part of it should be put into the mouth.

6. The blue monk's-hood is a taller plant than the foxglove, and has glossy, hand-shaped leaves. The flowers are blue, and in the form of a cowl, or hood, such as monks wear. Like the finger-flower of the foxglove, the hood-flower of the monk's-hood is easy to tell. Every part of this plant is very poisonous.

7. The meadow saffron is found in pastures. It is a small plant which grows from a bulb, and bears large, flat, spear-shaped leaves. It has a cup-shaped flower of a light purple colour, and

both the calyx (the flower cup) and the corolla (the flower leaves) are the same colour. The whole plant is poisonous.

8. And now let us consider an order or family of plants, many of which contain poison, and some of which are very dangerous. This is the nightshade family, four of which are shown in the coloured pictures on page 143. Curiously, one of our most useful food plants, the common potato, belongs to this order. You need not, however, be afraid of eating potatoes, unless they have become green by exposure to light and air. While the leaves and the berries of the potato plant are poisonous, the potato itself is both harmless and wholesome.

9. The worst or most dangerous of this family, and the most dangerous plant which grows in this country, is the deadly nightshade. You will know it by its large, egg-shaped leaves and dull purple, bell-shaped flowers. The berries, at first green, become black and shining, and grow to the size of a cherry. The plant is about three or four feet high, and grows in woods, old quarries, and among ruins. Its juice is called belladonna, and is used as a medicine.

10. The thornapple has white funnel-shaped flowers about two inches in length. The fruit has an outer covering of thorns, hence the name.

It contains, when ripe, black seeds. The plant has a strong, overpowering smell.

11. The bittersweet is a weak, straggling plant, which climbs up any bushes or trees near which it grows. Its leaves are heart-shaped, and its wheel-shaped flowers are purple, with a yellow centre, which stands out like a cone. The fruit is a small red berry rather longer than broad.

12. The henbane has a hairy stem and leaves, and dull yellow or cream-coloured flowers, marked with lines of purple. The flowers are in the form of a funnel or a trumpet.

13. There is one more plant on the coloured plate. It is the yew, an evergreen, often seen in gardens and churchyards. It bears needle-shaped leaves and red berries. A bare nut-like seed stands out at the open end of each berry. Both the leaves and the seeds of the yew are poisonous.

14. These are all the plants shown in the picture, but there are others which are likewise hurtful. I will describe a few of those which you are most likely to meet with—A kind of buttercup, found in damp places, with finger-shaped leaves; a laurel bush, with spear-shaped leaves and red berries; the spotted hartwort, or cuckoo-pint, with a bulbous root and red berries of the size of a pea; the four-leaved truelove, with a round berry of a bluish-black colour; and the

darnel, a weed found among corn, with bearded ears. Then you cannot be too careful about mushrooms. Let them alone if they have a disagreeable smell, hollow stalks, or feel sticky.

15. The right thing for you to do is to avoid all plants that you know to be poisonous. Do not even touch them, however pretty their flowers and fruit may be. Never, never, under any circumstances, eat, or even put into your mouth, the leaf, the fruit, or any part of an unknown plant.

16. If, however, any one happens to be poisoned in this way, remember that life or death may depend on quickness of action. Get a doctor at once. Till he comes the poisoned person should drink mustard and water—a tablespoonful of mustard in a cupful of warm water—to cause a vomit. You want to get the poison out of the stomach as quickly as you can.

17. Because some plants contain poison, and must not be handled or eaten, do not think that they are useless. In the hands of the doctor, some of the most deadly poisons are of the greatest value in certain cases of illness. Rightly used, they are among our greatest blessings.

## 32. THE LIGHTHOUSE.

**Lighthouses are—**Beacons by  
night.Landmarks by  
day.

On the coast.

On high cliffs.

On sandbanks.

On rocks.

**Lighthouses have—**Oil, gas, or electric  
lights.

Reflectors.

Keepers.

1. What we as a nation owe to lighthouses cannot be reckoned. Think for a moment what our country would be without them. We should be surrounded by a rugged, unfriendly coast, which no vessel could approach with safety in the darkness, while our shores would often be strewn with the timbers and cargoes of wrecked ships, and the bodies of their ill-fated passengers and crews.

2. At the present time the coast and harbour lights in the British Isles are more than eight hundred in number. Though lighthouses differ much in size and appearance, many of them are built in the form of a tower, like the trunk of a large tree without branches. They are wide at the base and gradually narrow towards the top.

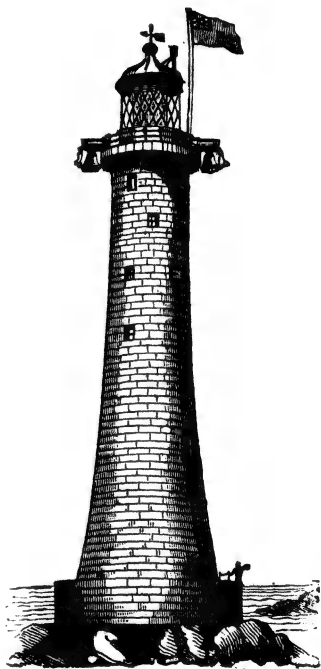
3. Each lighthouse has its own particular work to do, and therefore it has its own special features, that it may be known from every other lighthouse near. Some are built on headlands ; some on

islands ; some on solitary, wave-swept rocks ; and some on sandbanks.

4. One light points out the entrance to a safe harbour, another shows the position of a perilous reef, and a third tells of the presence of a dangerous sandbank. Here rises a noble tower, whose friendly rays may be seen from a distance of more than twenty miles, and there burns a light that only shows five miles away.

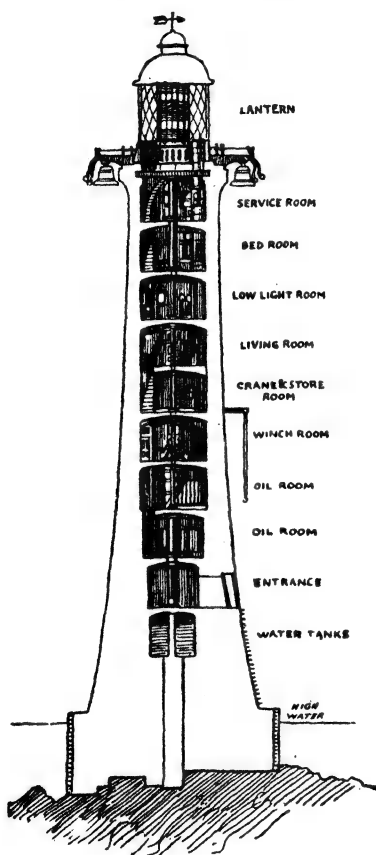
5. Some lights are fixed and others are revolving. One is a steady light, glowing constantly like a brilliant star ; another flashes forth from the deep darkness, flings over the sea its arrow of flame, and then is again lost, to appear a few moments later in the same striking manner.

6. A lighthouse must have the most powerful light that can be produced. None of the light must be wasted on the sky, but all sent by strong



NEW EDDYSTONE.

reflectors out to sea, where the light is wanted.



NEW EDDYSTONE.

Oil is most used because in out-of-the-way places an oil lamp is easily managed, and oil may be stored. Gas is used in lighthouses near towns. Several lighthouses have the electric light.

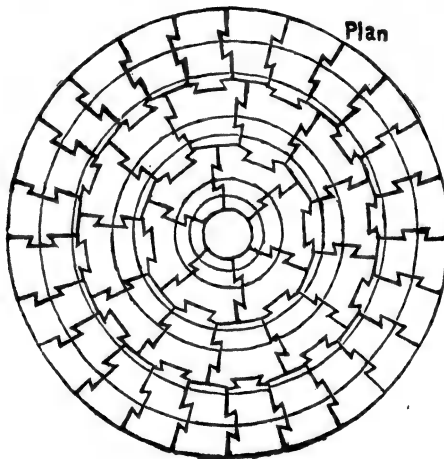
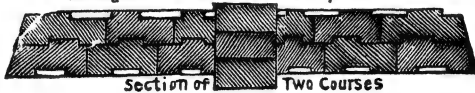
7. The foundations of some lighthouses are quarried out of the solid rock and firmly cemented together. From the foundation solid masonry is carried upwards for about thirty feet, when the building is divided off into rooms, one above another.

8. The Eddystone, off the south coast of England, stands on a reef of rocks in the English Channel, about ten miles from the shore.

The present building is the fourth which has occupied this site. This building was finished in 1882. It shows a white light that can be seen from a distance of about seventeen miles. The

### NEW EDDYSTONE

Arrangement of stones in lower part of Tower



light moves round, and flashes twice every half minute. Under the lantern gallery are suspended two large bells, which are rung in foggy weather.

## 33. KING COTTON.

Cotton grows—	Cotton is—	Cotton goods—
In pods.	Soft and white.	Calico.
On plants.	Woolly and fibrous.	Print.
In many hot	Spun into thread.	Muslin.
countries.	Woven into cloth.	Sewing thread.

1. Cotton is king in Lancashire. It has made Liverpool the greatest cotton port, and Manchester the chief cotton market, in the world. It has built thousands of mills, in which hundreds of thousands of persons are employed, and it provides millions of men, women, and children with their daily bread.

2. What is cotton, that it should be worthy of so much attention? In what does its great value lie? And how is it that it has become one of our greatest industries, seeing that every ounce of cotton we use must be brought from other lands?

3. First, I will tell you what cotton is. In certain hot countries—America, India, China, and Egypt—a shrub grows, which is known as the cotton plant. There are several kinds—one is only a small plant, another is five feet high and another grows to a height of twenty feet.

4. In appearance it is something like a hollyhock, with large dark green leaves and large yellow flowers. When the blossom falls, there

appears on the plant a dry pod about the size of a walnut. This is the fruit.

5. As this pod ripens, it bursts open, and there is seen a soft downy substance, as white as snow and as soft as wool. This soft down is cotton,



A COTTON FIELD.

and in it, safely packed away, are the seeds of the cotton plant.

6. Why is it there? To make the seeds light, so that the wind will blow them about and scatter them over the ground. Thistledown and other plants have their seeds attached to light sub

stances for the same purpose. It is one way that nature has of spreading seeds.

7. In the autumn a cotton field is a very pretty sight. Often the green leaves, yellow blossoms, and snowy cotton may be seen all mingled together. During the harvest every one is busy ; old and young, men, women, and children, are employed to gather the cotton into bags and baskets.

8. Negroes, whose forefathers were stolen from Africa and sold in America as slaves, do most of the work. They are better able to bear the heat of the sun than white men. There are still millions of negroes in America, but they are all free.

9. When the cotton has been dried in the sun it is cleaned. That is, the down is separated from the seeds. The machine used to do this work is called a cotton-gin.

10. When cleaned, the cotton is made up into great bundles called bales, each one of which weighs hundreds of pounds. It is now ready to be sent to the mills to be spun into thread and woven into cloth.

11. Both in America and in India there are cotton mills, and the people try to keep as much of the work as possible in their own lands. But a good deal of the " raw cotton," as it is called, is brought in ships to this country.

12. Some of the cotton is unloaded at Liver-



pool, and sent by railway to the towns where the mills are. Some of it is taken on to Manchester, and unloaded.

WINDING THE COTTON YARN.

(From the "English Illustrated Magazine.")

there, for that city has been a port since 1894. A ship canal, about thirty-five miles in length, connects Liverpool and Manchester.

13. Now the cotton has reached "Cotterdam," where it is king; we may fairly ask why it has been brought so far. And in what does its value lie?

14. Cotton is one of the most useful things in the world. It consists of very fine fibres, which can be spun into threads, and then woven into various kinds of cloth. In this form it is the chief article used in clothing the human race.

15. One question more we must not forget to answer. How is it that more cotton is bought by us than by any other country in the world? For you must remember that we cannot use it all in clothing ourselves. The reason is this: We have the richest coal-mines, the most perfect machines, and the finest ships in the world.

16. Our mines yield coal and iron, to make the machines and work them, and we can produce the best goods. Then our ships fetch the raw cotton, and carry the finished cloths to and from all parts of the world.

17. When the seeds of the cotton plant are not wanted for growing, they are crushed. They yield a good supply of oil, and the refuse is made into cotton-cake, which is used as a manure or as

cattle food. Cotton-oil is used in the making of soap, candles, and other useful things.

---

**Learn**—LESSON 33, *page* 190.

### 34 WHAT IS DEW ?

#### **Dew—**

Is moisture from the air.

Is condensed vapour.

Waters plants.

#### **Dew—**

Falls on the earth.

Falls in the evening.

Freezes and forms frost.

1. Sometimes when you are walking out in the evening, you leave the footpath and walk on the grass. When you return to the path, you find that your boots are wet, and yet there may not have been any rain for days.

2. Another time you get up early in the morning and go out into the fields or along the hedges to look for blackberries. The morning may be fine, and there may have been no rain for a week, and yet your boots are as wet as if you had been walking in the water.

3. What made the grass wet? It is not always so. If you go to the same fields in the middle of the day, you will often find the grass dry enough to sit on. How happens it, then, to be wet in the morning, dry during the day, and wet again in the evening?

4. You say that the grass is wet with dew. Yes ; most people know that. But only some people know what dew is, and how it comes only at certain parts of the day.

5. If you have read the lessons about water and vapour, you may be able to tell me what dew is. I think you will not make the mistake of thinking that it comes out of the ground.

6. Do you remember that word *condensation* ? And do you also remember how the water came on the inside of the sitting-room window, when the air was warm within and cold without ?

7. Dew is formed exactly in the same way, only the whole process is carried on in the open air. And this is how it takes place. The air always contains moisture—that is, water—in the form of vapour. But the moment it gets a chill, it lets some of it fall.

8. Now, when the sun sets at night, the earth loses some of the heat it has received during the day. And such thin things as grass and leaves soon become cold. Close to them is the air containing vapour. The cold grass and leaves touch it, condense the vapour, and it forms in drops on them.

9. Here is a plan by which you may find out for yourself how dew is formed—not by helping it, but by checking it. Fix four sticks in the

ground, fasten a cloth to them, and make a covering above the grass, but not touching it. In the morning you will find very little dew under the cloth, however much there may be on the grass around.

10. Why is this ? The cloth was so far above the grass that it did not prevent the air from touching it. True, but the cloth kept the heat from passing away quickly, and the grass under it was not cold enough to condense the vapour.

11. On cloudy nights there is less dew on the grass than on clear nights, because the clouds keep the heat from rising, and thus the air is not made cool.

12. Dew is of great use in watering plants in hot weather, when there is little rain. As it falls in the evening, they have plenty of time to drink it in before the sun comes in the morning to turn it back into vapour.

13. Sometimes, when you look out in the morning, you see everything covered with a thin coating of what is called hoar frost. This is really nothing but frozen dew. What pretty figures it sometimes makes on the window pane !

## 35. AN OCEAN STEAMER.

<b>A steamer is—</b>	<b>A steamer has—</b>	<b>It carries—</b>
Built of steel.	Engines. A captain.	Passengers.
Driven by steam-engines.	Screws. Engineers.	Goods.
	Funnels. A crew.	Letters.

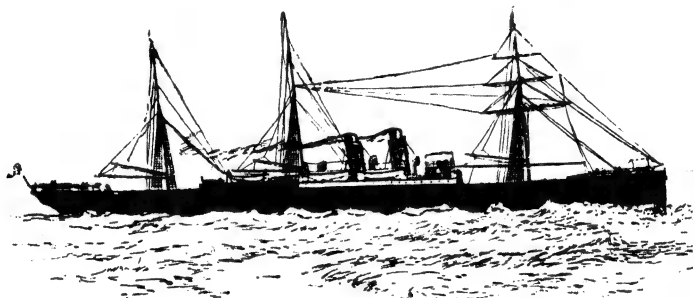
1. The British Isles lie in the Atlantic Ocean off the western shores of Europe. On the other side of this ocean are two great English-speaking countries, Canada and the United States of America. The Atlantic has thus become a great highway between the Old World and the New.

2. Vessels are constantly crossing and recrossing from shore to shore, bearing passengers and goods between British and American ports. And the great ocean, which even Columbus regarded with a certain amount of fear, is often spoken of as “a ferry.”

3. At one time the carrying trade was done by sailing vessels, which skimmed the waters like huge birds, and presented a striking picture of power and beauty. Sailing ships are still seen, but they are not as numerous as they once were. Time is money, and steam has obtained the mastery on water as well as land. We cannot afford to work machines by hand, or wait on the pleasure of the wind to be carried to any given port.

4. The "ocean greyhounds," as the steamers of to-day are called, cross the Atlantic in as many days as the sailing ships required weeks. A passenger may travel from England to America in one week, or even less.

5. Lying at anchor in the Mersey, an American liner has a striking appearance. The vessel gives one an idea of enormous size and great strength.



AN OCEAN STEAMER.

(From the "*English Illustrated Magazine*.")

We can scarcely believe that any waves can affect the movements of such a monster.

6. But when we go on board we are lost in wonder. The huge structure of steel, lying so quietly on the water, is everywhere full of life and activity. We seem to be in a great hotel crowded with people who have nowhere to go.

7. Passengers and crew often number over a thousand persons — the population of a small

town. According to the fare they have paid, they are placed in different parts of the ship, which we will call first, second, and third class. The lowest, or cheapest, fare is paid by the steerage passengers.

8. In a steamer, the most important part is the engine room—the place where the vessel is driven on day and night, either with or against both wind and tide. The engines are very powerful, and are able to force the steamer along at the rate of twenty miles an hour. They turn enormous screws with four blades, fixed at the stern of the vessel below the water line.

9. The chief engineer has charge of all the driving power, and as he moves about he knows every part of the engines so well that he can tell where he is by the noise. Greasy fellows, under him, stand about as if they had nothing to do, but they are intently watching every bit of machinery to see that it does its work.

10. Others, again, are constantly making their rounds, wiping a rod here and dropping oil there. A touch is enough to tell them if any part is working well or requires attention. One man is always on duty in front of a telegraph dial, ready to give the word should the captain signal for any change of movement.

11. Down in the stokehole, all grimy and sooty,



STEERAGE PASSENGERS

(From the "*English Illustrated Magazine*.")

over a hundred men are hard at work, feeding the furnaces, to keep up the steam required by the

engines. To give these men fresh air, a good strong breeze is forced down into their quarters by giant fans at work on the main deck.

12. The amount of coal used in a single voyage is enormous. A large steamer carries about three thousand tons, and burns between two and three hundred tons every twenty-four hours.

13. The food required by so many persons is also enormous. 70,000 lbs. of potatoes, 16,000 lbs. of peas and beans, 3,000 lbs. of sugar, 1,600 lbs. of coffee, 1,200 lbs. of tea, 17,000 lbs. of beef, 12,000 lbs. of mutton, and nearly 2,000 lbs. each of veal, bacon and ham, and smoked beef, 16,000 lbs. of fish, 7,000 lbs. of butter and over 1,000 lbs. of cheese, 10,000 eggs, 10,000 apples, and a great many other things, are carried every voyage.

14. Ocean steamers are built of steel and the plates are fastened together with rivets. Some of them are about five hundred feet in length and fifty feet wide, with several raised decks. The bottom of the ship is double, and there are water-tight compartments, so that if the side is stove in the vessel may not fill at once and go down. All the passengers are made as comfortable as possible, and the cabins are lighted by electric lights.

## EXERCISES ON THE LESSONS.

## 1. WHAT IS A PLANT?—page 7.

## 1. Notes and Meanings.

- |  |   |
|--|---|
| 3. <b>Com-plete'</b> , perfect ; finished.   | 11. <b>Ex-am'-ples</b> , specimens ; kinds. |
| 4. <b>In-cludes'</b> , contains ; comprises. | <b>Plant life</b> , any form or kind of     |
| 6. <b>Sponge</b> , a vegetable-like animal   | plant. [places.                             |
| found at the bottom of the sea.              | 13. <b>Mo'-tion</b> , the act of changing   |

2. **Summary**.—A plant is a living thing, which grows, and usually consists of a root, stem, and leaves. It has no feeling or motion like an animal, and is mostly fixed or rooted to one spot.

Some of the lower animals and plants are so much like each other in appearance, that we can scarcely tell whether they are animals or plants. Animals, however, are active, and attend to their own wants. Plants are passive. They receive from the soil and the air the things they need.

## 2. THE GREAT WORKER.—page 11.

## 1. Notes and Meanings.

- |   |  |
|---|--|
| 1. <b>The king</b> , the chief.                                 | 4. <b>Coke</b> , charred coal.             |
| 2. <b>Weap'-ons of war</b> , guns, swords, cannon, etc. [stone. | 8. <b>Cre'-ates</b> , makes.               |
| 3. <b>Ore</b> , metal mixed with earth and                      | 11. <b>Molt'-en</b> , melted by heat.      |
| <b>Min'-er-al</b> , a substance dug out                         | 14. <b>Cast</b> , moulded while soft.      |
| of a mine.  | 15. <b>Wrought</b> , formed by labour.     |
| 4. <b>Smelt'-ed</b> , melted by heat.                           | 20. <b>Raw materials</b> , unmanufactured. |

2. **Summary**.—Iron is the most useful of all our metals. It is a mineral, and is dug out of mines in the form of an ore—that is, metal mixed with earth and stones.

It is roasted, and then smelted in a furnace, with coal or coke and limestone. The melted iron sinks to the bottom, and is run off into moulds. This is called cast iron.

When again heated and worked it is called wrought iron. Steel is iron made very hard and elastic by means of heat and air. Cast iron is brittle. Wrought iron is flexible and malleable. Steel is flexible, elastic, and malleable.

## 3. WHAT IS AIR?—page 17.

## 1. Notes and Meanings.

- |   |   |
|---|---|
| 2. <b>Emp'-ty</b> , vacant space; so-called when it contains nothing but air. | 7. <b>Wind</b> , air in motion.         |
| <b>Space</b> , room.  | 10. <b>Par'-ti-cles</b> , minute parts. |
| 6. <b>Draught</b> ( <i>draft</i> ), air current.                              | 14. <b>Ox'-y-gen</b> , } natural gases. |
|   | <b>Ni'-tro-gen</b> , }                  |
|   | 16. <b>E'-qual</b> , exactly the same.  |

2. **Summary**.—Air is everywhere. It is one of the most common things in the world, and one of the things that we cannot do without. We should die if we could not get air.

The places which we call "empty" are filled with air. We cannot see air, but we can feel it when it moves. Wind and breeze are names given to air in motion.

Air is a gas made up of two other gases—oxygen gas and nitrogen gas. It is a fluid, light, transparent, and invisible; it flows in every direction.

## 4. THE PARTS OF A PLANT.—page 21.

## 1. Notes and Meanings.

- |  |  |
|--|--|
| 1. <b>Stur'-dy</b> , stout and strong. | 4. <b>Hin'-dered</b> , kept back; prevented. |
| <b>Dif'-fer</b> , are unlike.          | 7. <b>Ob'-ject</b> , purpose; intention.     |
| 3. <b>Lungs</b> , breathing organs.    | 9. <b>Va-ry</b> , differ; are unlike.        |
| <b>Stom'-achs</b> , digesting organs.  | 10. <b>Sole</b> , only.                      |
| <b>Spe'-cial</b> , particular.         | 11. <b>In-crease'</b> , multiply.            |

2. **Summary**.—Plants are not all alike in appearance. Most of them consist of three parts—the root, the stem, and the leaves. These are the organs of the plants, and are needed for its life and growth.

The root grows downwards, and is mostly underground. The stem grows upwards, and in trees is called a trunk. The leaves grow out of the stem and its branches. Most plants also produce flowers, fruit, and seeds, out of which new plants are formed.

## 5. HOW KNIVES ARE MADE.—page 25.

## 1. Notes and Meanings.

- |   |  |
|---|--|
| 1. <b>Rid'-ing</b> , a third part.                      | 6. <b>Weld'-ed</b> , beaten together.    |
| 2. <b>Cut'-ler</b> , one who makes cutting instruments. | <b>Haft</b> , handle.                    |
| <b>For'-ges</b> , beats into shape.                     | 7. <b>Tem'-per-ing</b> , making elastic. |
| 4. <b>Flint</b> , a hard stone.                         | 9. <b>E-las'-tic</b> , will spring back. |
|   | 11. <b>In-sert'-ed</b> , stuck in.       |

**2. Summary.**—Sheffield is the chief seat of the cutlery industry. Cutlers are clever, skilled workmen, and their chief tool is a hammer. They use very little machinery.

Knife blades are forged or beaten out of bars of steel made red-hot. They are then hardened, tempered, ground, and polished. Knife handles are made of ivory, mother-of-pearl, tortoiseshell, horn, and many other materials.

## 6. THE AIR WE BREATHE.—page 80.

### 1. Notes and Meanings.

- |  |  |
|--|--|
| 5. <b>Im'-pure</b> , not fit to breathe. | 11. <b>Poi'-son</b> , anything which, taken inwardly, destroys life. |
| 8. <b>Tubes</b> , pipe-like passages.    | 13. <b>Heat</b> , natural warmth.                                    |
| 9. <b>Com'-bines</b> , mixes.            | 14. <b>Ven-ti-la'-tion</b> , changing the air in a room.             |
| <b>Car'-bon</b> , pure charcoal.         |  |
| 10. <b>Com'-posed</b> , made up.         |  |

**2. Summary.**—We cannot breathe without air, therefore we cannot live without air. Good or pure air contains a certain quantity of oxygen. We make air impure by passing it through our lungs.

We breathe oxygen in and carbonic acid out. Carbonic acid gas is a deadly poison. By ventilating our rooms we change bad air for good air. Gaslights make the air impure.

## 7. HOW PLANTS GROW FROM SEEDS.—page 87.

### 1. Notes and Meanings.

- |  |   |
|--|---|
| 1. <b>A-sleep'</b> , in a state of rest. | 11. <b>Ex-posed'</b> , laid open.   |
| 3. <b>Moist'-ure</b> , dampness.         | <b>Sur'-face</b> , top ; upper part.  |
| 5. <b>Pods</b> , seed cases of peas.     | 14. <b>Ran'-ners</b> , thread-like branches of a plant, which take root at the end. |
| 8. <b>Sim'-i-lar</b> , like.             |   |
| 9. <b>Sel'-dom</b> , not often ; rarely. |   |

**2. Summary.**—A seed often retains its life for a long time. When it is put into the ground the moisture causes it to sprout. A root goes down, and a stem comes up and forms a new plant.

Gardeners often grow new plants from cuttings, on which there are buds. Some plants throw out branches or stems, which strike root and produce new plants.

## 8. ALL ABOUT BUTTONS.—page 42.

## 1. Notes and Meanings.

- |  |  |
|--|--|
| 1. <b>Gar'-ments</b> , articles of clothing.                   | 6. <b>Man'-gling</b> , passing through a machine with large rollers. |
| 2. <b>Va-ri'-e-ty</b> , different kinds.                       | 7. <b>Can'-vas</b> , coarse cloth.                                   |
| 3. <b>Ma-te'-ri-als</b> , substances of which things are made. | <b>Tuft</b> , risen part.  |
| <b>Veg'-e-table</b> , belonging to plants.                     | 9. <b>Porce'-lain</b> , china-ware.                                  |

2. **Summary**.—Buttons are used to fasten garments and to ornament articles of clothing. They hold firmly, look neat, and are very cheap. They are made of all sizes, and of a great many different materials.

Those most commonly used are metal, linen, or cloth. Linen buttons are of great use for underclothing and garments which have to be washed. Birmingham is the seat of the button trade, where these useful articles are made in immense numbers.

## 9. THE AIR PLANTS BREATHE.—page 44.

## 1. Notes and Meanings.

- |   |   |
|---|---|
| 2. <b>Poi'-son-ous</b> , hurtful to life.           | 6. <b>Soil</b> , upper surface of earth.                          |
| 4. <b>Op'-po-site</b> , contrary ; quite different. | 7. <b>Source</b> , that from which anything proceeds.             |
| <b>Pu'-ri-fy</b> , make clean.                      | 8. <b>Cells</b> , small bags of juice of which plants are formed. |
| 5. <b>In-crease'</b> , become larger.               |   |

2. **Summary**.—Both persons and animals need the same kind of air. They take in nitrogen and oxygen, and send out nitrogen and carbonic acid. Plants take in carbonic acid and send out oxygen.

Persons and animals make the air impure for themselves, and plants make it pure again. The leaves of plants take in the carbonic acid gas, which they require, and change it into the materials of which plants are made.

## 10. THE ROOTS OF PLANTS.—page 47.

## 1. Notes and Meanings.

- |  |   |
|--|---|
| 1. <b>Nour'-ish-ment</b> , food ; support.   | 5. <b>Crops</b> , plants grown.                                   |
| 2. <b>Pure</b> , free from other substances. | <b>En-rich'</b> , make fruitful.                                  |
| <b>Dis-solved'</b> , made liquid.            | <b>Ma-nure'</b> , anything put into the ground to make it richer. |
| 4. <b>With'-er</b> , fade.                   |   |

**2. Summary.**—Plants obtain some of the food they require from the soil by means of their roots. They suck up water, which contains dissolved substances. All plants do not require the same kind of food. Farmers therefore change their crops.

Roots grow downwards, feed plants, and fix them in the ground. Roots are fibrous, fleshy, and woody. Some plants grow in the air and do not obtain food from the soil.

## 11. HOW PINS ARE MADE.—page 56.

### 1. Notes and Meanings.

- |  |                                     |
|--|-------------------------------------|
| 2. <b>Cost'-ly</b> , high priced.          | 8. <b>Coat'-ed</b> , covered.       |
| 3. <b>Sep'-a-rate-ly</b> , apart ; singly. | <b>Bran</b> , husks of corn.        |
| 4. <b>Pro'-cess</b> , how it is done.      | 10. <b>Pur'-pos-es</b> , uses.      |
| 5. <b>Co'l'd</b> , wound round.            | <b>Var'-nish</b> , a glossy liquid. |
| <b>Reel</b> , a kind of bobbin.            | 11. <b>Pat'-terns</b> , shapes.     |

**2. Summary.**—Pins are very cheap and common. We use them to fasten things. They are made of brass or steel wire. A pin is made by one machine, which turns out 160 complete pins a minute.

The process of pin-making is as follows : the wire is drawn, wound, straightened, and cut into lengths. The pins are headed, pointed, whitened, polished, and stuck into paper in rows. They are made of various sizes. Some pins are made of silver and gold. Safety-pins do not prick the wearer.

## 12. WHAT IS WATER ?—page 59.

### 1. Notes and Meanings.

- |  |  |
|--|--|
| 2. <b>En'-ve-lope</b> , a wrapper in which anything is enclosed. | 7. <b>Va'-pour</b> , a form of air.                  |
| <b>Re'-gions</b> , parts of the world.                           | 11. <b>Soiled</b> , made impure.                     |
| 3. <b>Glance</b> , one look.                                     | 13. <b>Re-tains'</b> , holds ; keeps.                |
| 5. <b>Kid'-neys</b> , organs of the body.                        | 14. <b>Lath'-er</b> , foam made with water and soap. |

**2. Summary.**—Water is a substance in a liquid form, produced by Nature. It is the world's drink, and is necessary to support the life of men, animals, and plants.

Three-quarters of the earth's surface is covered with water. Persons, animals, and plants consist largely of water, and it exists in the air in the form of vapour. Water is made of oxygen and hydrogen. It is never wholly pure.

## 13. THE STEMS OF PLANTS.—page 62.

## 1. Notes and Meanings.

- |  |   |
|--|---|
| 8. <b>Pith</b> , the soft, spongy substance in the centre of plants. | 4. <b>An'-nu-als</b> , plants which live only one year. |
| <b>Fi'-brous</b> , made up of small threads.                         | 7. <b>Pre'-vi-ous</b> , one before. [leaves.            |
|  | 12. <b>Palm</b> , a tree having palm-like               |

2. **Summary**.—The stems of plants are made up of pith, which is soft and fleshy, and fibres which are hard and woody. Most trees have woody stems which increase by adding a new layer of wood each year. Plants of this kind are called outside growers.

Inside growers do not form rings or layers in the stem. The fibres are mixed among the pith. The oak is an outside grower. The palm is one of the largest of the inside growers.

## 14. CURIOUS STEMS.—page 65.

## 1. Notes and Meanings.

- |   |   |
|---|---|
| 2. <b>Climb'-ing</b> , holding on.                          | 4. <b>Root'-stock</b> , a stem which produces roots and buds. |
| <b>Root'-lets</b> , little roots.                           | 6. <b>De-cayed'</b> , died; withered away.                    |
| <b>Ten'-drils</b> , twining shoots of some climbing plants. | 7. <b>Bulb</b> , a round underground stem.                    |
| 4. <b>Pros'-trate</b> , lying down.                         |   |

2. **Summary**.—Some stems are too weak to support their own weight. Some plants climb by holding on to other objects, by means of little rootlets and tendrils, or by twining themselves round their support. Climbers and twiners are often trained to run up walls.

Some plants have underground stems such as rootstocks, bulbs, and tubers. These are not true roots, but simply swollen stems, in which there are substances stored up for the future use of the plants.

## 15. HOW NEEDLES ARE MADE.—page 78.

## 1. Notes and Meanings

- |  |  |
|--|--|
| 1. <b>Awls</b> , sharp instruments for boring holes. | 7. <b>Fan</b> , an instrument used to set air in motion. |
| 2. <b>In-vented'</b> , found out how to make.        | 14. <b>Scour'-ing</b> , cleansing by rubbing.            |
| a mixture of copper and tin.                         | 15. <b>Cha'-mois</b> ( <i>shammy</i> ), a kind of goat.  |

2. **Summary.**—Needles are used for sewing. They are made of steel wire, which is cut into lengths and then straightened. When pointed, the needles are stamped and the eyes pierced in a punching machine. They are then hardened, tempered, and polished. Great care is taken in making the eyes, so that the edges may not cut or fray the thread in sewing.

Redditch, a small town in Worcestershire, is the seat of the needle industry. Millions of needles are made every year in this town and the surrounding neighbourhood.

## 16. AIR AND WATER COMPARED.—page 77.

### 1. Notes and Meanings.

- |  |  |
|--|--|
| 4. <b>Com-bi-na'-tion</b> , union.         | 9. <b>Dense</b> , thick ; close.         |
| 5. <b>Qual'-i-ties</b> , properties.       | 10. <b>Flu'-ids</b> , things which flow. |
| 7. <b>Pro-por'-tions</b> , relative parts. | 13. <b>Sur'-face</b> , outside.          |
| <b>Ve'-ry</b> , change ; are altered.      | 14. <b>Re-tain'</b> , keep.              |
| 8. <b>Prop'-er-ties</b> , qualities.       | 16. <b>Suit</b> , fit.                   |

2. **Summary.**—Air and water are natural substances. They are both fluids, transparent, and without colour, taste, smell, or shape. They have both bulk or size

Air is a gas, and consists of a mixture of oxygen and nitrogen. It spreads every way, and is without surface or outside. It changes its size according to the space.

Water is a liquid, and consists of a combination of oxygen and hydrogen. It always flows down and finds its level. It retains its

## 17 HOW CROCKERY IS MADE.—page 82.

### 1. Notes and Meanings.

- |   |  |
|---|--|
| 1. <b>Rude</b> , roughly made.                                | 8. <b>Fash'-ion</b> , make ; shape.                  |
| 2. <b>Cen'-tre</b> , chief place.                             | 9. <b>Re-volve'</b> , turn round.                    |
| 3. <b>Kiln</b> , a large stove or oven for burning or drying. | 10. <b>Mould'-ed</b> , shaped in a mould while soft. |
| 4. <b>Re-duce'</b> , break up ; grind.                        | 11. <b>Flues</b> , chimneys ; pipes.                 |

2 **Summary.**—The pottery trade is largely carried on in North Staffordshire, with Stoke-on-Trent as the centre. The clay is brought from Devon and Cornwall. Coarse clay for making cases for holding the crockery in the kiln is found on the spot.

Crockery is made of clay, china stone, bones, and flint crushed to powder, and made into a paste. The ware is formed by throwing on a potter's wheel. It is then baked in an oven, and afterwards printed and glazed.

## 18. AIR CURRENTS.—page 87.

## 1. Notes and Meanings.

- |   |   |
|---|---|
| 1. <b>Air cur'-rents</b> , streams of air passing in and out of a room. It is simply air in motion. This is called ventilation. | 5. <b>Ex-pands'</b> , becomes larger by spreading and being less dense. |
|   | 6. <b>Ven-ti-la'-ted</b> , air changed.                                 |
|   | 7. <b>Sash</b> , wooden frame.  |

2. **Summary**.—To keep the air fresh in a room, it must be changed as often as possible. This is done by means of air currents. Bad air flows out of the room, and good air flows in to take its place.

The air inside a room is always warmer than the air outside. The warm air escapes through any opening, by the chimney or window. A fire in a grate assists ventilation, and increases the draught. Fresh air should enter as near the top as possible.

## 19. THE LEAVES OF PLANTS.—page 92.

## 1. Notes and Meanings.

- |  |  |
|--|--|
| 1. <b>Ex-am'-ples</b> , specimens ; similar things.                        | 5. <b>Mid'-rib</b> , the middle rib in a leaf.                     |
| <b>Ev'-er-greens</b> , trees which retain their leaves all the year round. | 8. <b>In-dent'-ed</b> , cut in the edge like teeth.                |
| 2. <b>Wak'-ing</b> , beginning to grow.                                    | 16. <b>Dis-solved'</b> , made liquid ; broken up into small parts. |

2. **Summary**.—The leaves of trees are thin, green blades, which grow out of the stem and its branches. They feed the plants on which they grow by taking in the air-food, which the plants require.

Leaves differ so much in shape that no two of them growing on the same tree are exactly alike. Simple leaves are not divided to the mid-rib. Compound leaves are made up of smaller leaves or leaflets. The leaves of the pitcher plant hold water. The leaves of the Venus's fly-trap catch flies and other insects.

## 20. STRIKE A LIGHT.—page 1

## 1. Notes and Meanings.

- |   |  |
|---|--|
| 1. <b>In-ven'-tion</b> , something newly found out or made. | a mineral substance of a yellow colour.                                |
| 3. <b>Phos'-phor-us</b> , a substance which will burn.      | 3. <b>Pop'-u-lar</b> , liked by the people.                            |
| <b>Sul'-phur</b> , also called brimstone ;                  | 12. <b>In-sur'-ance</b> , security against loss by a payment of money. |

**2. Summary.**—Matches are so cheap that we can buy a hundred for a farthing. They are made of strips of wood or thin wax tapers dipped in a mixture of chlorate of potash, glue, whiting, powdered glass, and phosphorus.

Vesuvians, fusees, and flammers are made to burn slowly, and to consume only the head. Safety matches are made to strike a light only on the box.

## 21. HOW WATER TURNS INTO VAPOUR.—page 108.

### 1. Notes and Meanings.

- |  |  |
|--|--|
| 2. <b>Steam</b> , the vapour of hot water. | remains until it is turned into        |
| 5. <b>Va'-pour</b> , a kind of gas, which  | water.                                 |
| rises from the earth and                   | 10. <b>Ceased</b> , stopped.           |
| passes into the air, where it              | 14. <b>Pro'-cess</b> , way it is done. |

**2. Summary.**—When water is boiled it gradually disappears. The heat turns the water into vapour, which mixes with the air, and is carried off.

It is lighter than the air, and therefore rises until it receives a chill, when it is again changed into water. The heat of the sun also causes water to change into vapour. This process is called **evaporation**.

## 22. FLOWERS AND BLOSSOMS.—page 109.

### 1. Notes and Meanings.

- |  |  |
|--|--|
| 1. <b>Per'-son-al</b> , belonging to a       | 8. <b>Cal'-en-dar</b> , almanack ; the |
| person.                                      | months arranged in their               |
| 2. <b>Per'-fume</b> , smell ; scent.         | order.                                 |
| 3. <b>Ob'-ject</b> , purpose ; plan.         | 13. <b>Ca'-lyx</b> , flower cup.       |
| 5. <b>Va'-ri-et-y</b> , change ; difference. | <b>Cor-ol'-la</b> , flower leaves.     |

**2. Summary.**—Flowers are much prized for their graceful forms, beautiful colour, and sweet perfumes. Though there are many kinds, there are not two alike.

Insects feed on the sweet juices found in the flower cups. The chief use of flowers is to hold that which goes to make the seeds of a new plant. When the flower fades, it leaves behind the seed-vessel or fruit.

**23. HOW COAL GAS IS MADE.**—*page 114.***1. Notes and Meanings.**

- |  |   |
|--|---|
| 1. <b>Pound'-ed</b> , beaten small like powder.            | 4. <b>Ex'-it</b> , going out.                                       |
| 2. <b>Re-torts'</b> , a kind of oven in which gas is made. | 5. <b>Ga-som'-eter</b> , a large vessel to hold and to measure gas. |
| 4. <b>Fur'-nace</b> , enclosed fireplace.                  | 9. <b>Con-struct'-ed</b> , made; formed.                            |
|  | 11. <b>Ex-plo'-sion</b> , sudden bursting.                          |

**2. Summary.**—Coal contains gas, which will burn when it comes in contact with a light. It is much lighter in weight than common air. It is invisible, transparent, and has a strong smell.

Gas is obtained by burning coal in a retort. The heat drives off the gas, and leaves behind coke. Gas lights our houses, and is used for cooking and for driving engines.

**24. WHY A BALLOON ASCENDS.**—*page 119.***1. Notes and Meanings.**

- |   |   |
|---|---|
| 1. <b>Lath'-er</b> , foam made with water and soap. | 15. <b>Valve</b> , a door which opens in one direction and closes in another. |
| Bubbles, soap and water balloons.                   | 19. <b>Paris</b> , the capital of France.                                     |
| 9. <b>Ex-pand'</b> , spread out.                    | <b>Cap'-tured</b> , taken; seized.  |

**2. Summary.**—Balloons are bags of paper or silk, filled with hot air or coal gas. They are very light, and will ascend quickly and float easily. Basket-work cars are suspended from balloons by means of cords. In them persons and things may be carried through the air.

When the gas is allowed to escape through a valve in the top, the balloon descends to the ground. Balloons have ascended to a height of seven or eight miles.

**25. FRUITS AND SEEDS.**—*page 128.***1. Notes and Meanings.**

- |  |  |
|--|--|
| 2. <b>Whole'-some</b> , good for food.     | 5. <b>Ob'-long</b> , longer than broad.        |
| 4. <b>Pulp</b> , the soft part of a fruit. | 8. <b>Prune</b> , a dried plum.                |
| <b>Core</b> , the heart.                   | 10. <b>Di-gest'</b> , dissolve in the stomach. |
| <b>Pips</b> , seeds of apples, etc.        | 13. <b>Scur'-vy</b> , an illness.              |

**2. Summary.**—The fruit of a plant is the seed-vessel or seed-nolder, which appears at the end of the flower stalk when the blossoms fall off.

Some kinds of fruit are much larger than is needed to hold the seeds, and form a juicy pulp, which is used for food. Some fruits are wholesome, and are eaten raw or cooked. Among these are the apple the pear, the plum, the cherry, the orange, and the lemon.

## 26. MORE FRUITS AND SEEDS.—page 182.

### 1. Notes and Meanings.

- |   |  |
|---|--|
| 1. <b>Em-bed'-ded</b> , enclosed ; lie as in a bed. | 3. <b>Cas'-pian Sea</b> , south-east of Russia. [London. |
| 2. <b>Cli'-mate</b> , condition of weather.         | 4. <b>Hampton Court Palace</b> , near                    |
| <b>Cul'-ti-vat-ed</b> , grown and looked after.     | 11. <b>E-rect'</b> , straight up.                        |
|   | 13. <b>Hard'-i-er</b> , stronger.                        |

**2. Summary.**—Many kinds of fruit-berries grow on bushes and climbing-plants. They have soft, juicy pulp, in which the seeds are enclosed.

Grapes have a rich delicate flavour. They grow on climbing-plants called vines. Gooseberries grow on prickly bushes. Raspberries grow on prickly canes. Blackberries grow on bramble-bushes. Strawberries grow on plants called runners.

## 27. DRY FRUITS.—page 186.

### 1. Notes and Meanings.

- |  |   |
|--|---|
| 1. <b>Dis-charge'</b> , put off.                                   | 12. <b>Com-pact'</b> , solid.                         |
| 8. <b>Pulse</b> , seeds which grow in pods, and are good for food. | 13. <b>Im-por'-tant</b> , valuable.                   |
| <b>Nature</b> , having the same qualities.                         | 15. <b>Scal'-y</b> , covered with scales.             |
|  | 16. <b>Fi'-brous</b> , made up of thread-like fibres. |

**2. Summary.**—Dry fruits ripen without forming a pulp. Some kinds, like peas and beans, are contained in pods, which split to discharge the seeds; others, such as grains and nuts, retain the seed-vessels in which they grow.

All seed-vessels are as much fruit as apples and oranges are. Peas, beans, and lentils are dry fruits, called pulse. Grains grow in ears on a kind of grass called straw.

**28. THE LIFEBOAT.**—page 145.**1. Notes and Meanings.**

- |  |                                     |
|--|-------------------------------------|
| 1. <b>I-mag'-ine</b> , think of, fancy.  | 4. <b>A-roused'</b> , awakened.     |
| <b>Light'-ship</b> , a vessel anchored<br>and showing a light to serve as<br>a lighthouse. | 5. <b>Cox'-swain</b> , steersman.   |
| 3. <b>An-noun'-ces</b> , makes known.  | 6. <b>Ex-haust'-ed</b> , tired out. |
|  | 7. <b>Ca'-pa-ble</b> , able.        |
|  | 9. <b>Keel</b> , bottom of a boat.  |

**2. Summary.**—Lifeboats are kept on the sea coast to save the passengers and crews of wrecked vessels. Lifeboats will not sink, and can support more than they can hold.

They have air-chambers, or watertight compartments, which make them lighter than water. Lifeboats are self-righting, and discharge any water which may be shipped. There are more than 300 lifeboats on our shores.

**29. THE GOLDEN FLEECE.**—page 149.**1. Notes and Meanings.**

- |   |   |
|---|---|
| 3. <b>Rom'-ans</b> , invaded Britain nearly<br>2,000 years ago. | 6. <b>Cry</b> , demand.                               |
| 4. <b>An'-nu-al</b> , yearly.                                   | 7. <b>Beared</b> , cared for.                         |
| 5. <b>Spin'-ing</b> , twisting into thread.                     | 9. <b>Fleece</b> , all the wool cut off one<br>sheep. |
| <b>Weav'-ing</b> , making cloth.                                | 10. <b>Kan'-g ar-oo</b> , a pouched animal.           |

**2. Summary.**—The West Riding of Yorkshire, with Leeds and Bradford as centres, is the seat of the woollen industry. Hundreds of thousands of persons are employed in the woollen factories.

We are not able to grow as much wool as we require, and we import large quantities from Australia, New Zealand, and South America. Australia is sometimes called the "Land of the Golden Fleece."

Wool is the soft fleecy covering of certain animals, such as the sheep. It is soft, light, warm, porous, and fibrous, and makes the warmest and most healthy clothing.

**30. HOW VAPOUR TURNS INTO WATER.**—page 151.**1. Notes and Meanings.**

- |   |  |
|---|--|
| 5. <b>Con'-tact</b> , touch.                              | 10. <b>Moist'-ure</b> , damp in any form.                      |
| 6. <b>Scale</b> , plan or scheme.                         | 15. <b>E-vap-o-ra'-tion</b> , water chang-<br>ing into vapour. |
| 7. <b>High mountains</b> , the Alps and<br>the Himalayas. | <b>Con-den-sa'-tion</b> , vapour chang-<br>ing into water.     |
| 3. <b>In-tense'</b> , severe.                             |  |

**2. Summary.**—Water is being constantly changed into vapour and carried off by the air. Heat changes water into vapour, and cold changes the vapour back again into water. This process, which is often seen inside a room that contains a fire, is carried on outside by the sun.

The vapour being lighter than common air, rises until it receives a chill, when it turns again into water and falls as rain. In this way the earth is watered and streams are constantly supplied.

### 31. PLANTS WHICH POISON.—page 155.

#### 1. Notes and Meanings.

5. **Fox'-glove**, folk's or fairy's glove.

**Bel-la-don'-na**, means "a fair

7. **Pas'-tures**, ground covered with grass for cattle.

lady." It was so called because ladies used it at their toilet.

8 **Ex-po'-sure**, being laid open.

**2. Summary.**—There are plants which grow wild in this country that are very poisonous. Among them are some which bear pretty flowers and berries, in appearance like those good for food.

Plants of the nightshade family are the most poisonous. Mushroom and plants of that family are also sometimes hurtful.

Children should never eat any wild fruits that they are not quite sure are wholesome and harmless. If poisoned by doing so not a moment is to be lost. Drink mustard and water and send for a doctor.

### 32. THE LIGHTHOUSE.—page 160.

#### 1. Notes and Meanings.

1 **Car-goes**, goods carried by ves-

6. **Re-flect'-ors**, anything which throws back light.

2. **Grad'-u-al-ly**, little by little.

**E-lec'-tric light**. Electricity is a property possessed by some substances, which can be used as a force.

4. **Per'-i-lous**, very dangerous.

5. **Re-volv'-ing**, turning round and round.

**2. Summary.**—Lighthouses are buildings erected in or near the sea to serve as beacons by night and landmarks by day. They are built on the coast on capes and headlands; on rocks and sandbanks.

They have powerful lights; oil, gas, and electricity being used for this purpose. By means of reflectors the light is thrown far out to sea. Some lighthouses have revolving and flashing lights. The Eddystone Lighthouse is the most famous on our shores.

**33. KING COTTON.**—page 164.**1. Notes and Meanings.**

- |   |   |
|---|---|
| 1. <b>King</b> , the most important thing.        | 10. <b>Spun</b> , twisted into threads.                     |
| 7. <b>Min'-gled</b> , mixed ; blended.            | 11. <b>Raw cot'-ten</b> , cotton before it is manufactured. |
| 8. <b>Ne'-groes</b> , blacks ; natives of Africa. | 13. <b>Cottondom</b> , the land of cotton.                  |

**2. Summary.**—South Lancashire, with Manchester as its centre, is the chief seat of the cotton trade. Liverpool is the greatest cotton port, and Manchester is the chief cotton market in the world.

Cotton is the soft, white, downy substance which grows in the fruit of the cotton plant, and contains the seeds. It grows in India, China, Egypt, America, and other hot countries. It is brought to this country to be manufactured, because we have a supply of coal and iron.

**34. WHAT IS DEW ?**—page 169.

**Summary.**—Dew is moisture from the air. It is condensed vapour, which falls on the earth in the evening. It is caused by the cooling of the earth when the sun goes down, and this in turn cools the vapour in the air. It is of great use in watering plants when there is little rain. Hoar frost is frozen dew.

**35. AN OCEAN STEAMER.**—page 172.**1. Notes and Meanings.**

- |  |   |
|--|---|
| 1. <b>High'-way</b> , path or road.              | 4 <b>O'-cean greyhounds</b> , fast steamers.  |
| Old World, Europe, Asia, and Africa.             | 6. <b>Struc'-ture</b> , vessel ; building.  |
| New, America.                                    | <b>Ho-tel'</b> , lodging-house.   |
| 2. <b>C. lumbus</b> , the discoverer of America. | 8. <b>Water line</b> , line on the sides of vessels showing the height the water comes. |

**2. Summary.**—Ocean steamers are built of steel and driven by steam. They have powerful engines, and are driven through the water by means of screws. They sail very fast, and often cross the Atlantic in a week. They have watertight compartments to prevent the vessel from sinking, if the side is stove in.

**ARNOLD'S SCHOOL SERIES.**

## **THE RANGER SERIES**

64 pp.]

OF

[PRICE 3d.

### **SCENES FROM POPULAR BOOKS.**

**CONTINUITY COMBINED WITH VARIETY.**

The aim of this new Series is to provide healthy, interesting reading for children in Senior Classes. Each book is not an abridged edition, but a Series of the most Dramatic Scenes from some work by a popular author. The scenes are connected by short paragraphs, which keep up the continuity, and make each book *complete* in itself.

Well printed in Bold Type on Good Paper.

Spirited Illustrations. Explanatory Notes.

**NOW READY.**

**The Rifle Rangers.** By MAYNE REID.

**Westward Ho!** By CHARLES KINGSLEY.

**The Pathfinder.** By J. F. COOPER.

**The Spy.** By J. F. COOPER.

**Peter the Whaler.** By W. H. G. KINGSTON.

**Poor Jack.** By CAPTAIN MARRYAT.

**Children of the New Forest.** By CAPTAIN MARRYAT.

**It is Never Too Late to Mend.** By CHARLES READE

**Kenneth.** By C. M. YONGE.

**A Christmas Carol.** By CHARLES DICKENS.

**Fairy Tales.** By HANS ANDERSEN.

**The Wonder Book.** By NATHANIEL HAWTHORNE.

**Ivanhoe.** By SIR WALTER SCOTT.

**The Last of the Mohicans.** By J. F. COOPER.

**Little Women.** By L. M. ALCOTT.

**THE FAVOURITE CHEAP SUPPLEMENTARY READERS.**

*THE ABOVE BOOKS FORM EXCELLENT READERS FOR EVENING SCHOOLS AND FOR THE HOME.*

**THE**

## **COMPANION RANGER SERIES.**

**Price 1s. 6d. each.**

Each book of this series contains four of the original Ranger Series, bound together in cloth, to meet the needs of those teachers who desire to obtain the Ranger Series in a more permanent form.

**These Books afford both Continuity and Variety in Reading.**

**CONTENTS OF THE VOLUMES.**

**VOL. I.** Westward Ho! The Pathfinder. Children of the New Forest. The Rifle Rangers.

**VOL. II.** Ivanhoe. The Spy. Peter the Whaler. It is Never Too Late to Mend.

**VOL. III.** A Christmas Carol. The Last of the Mohicans. Poor Jack. Kenneth.

**EDWARD ARNOLD, 41 & 43 MADDOX STREET, LONDON, W.**

## **ARNOLD'S SCHOOL SERIES.**

THE

# **KING ALFRED LITERARY READERS.**

IN EIGHT VOLUMES.

BEAUTIFULLY ILLUSTRATED IN COLOUR AND BLACK  
AND WHITE.

*INSTRUCTIVE—ATTRACTIVE—EDUCATIVE.*

### LIST OF THE SERIES.

<b>INTRODUCTORY READER</b>	96 pages.	Price 8d.
<b>BOOK I.</b>	128 pages.	Price 10d.
<b>BOOK II.</b>	160 pages.	Price 1s.
<b>BOOK III.</b>	188 pages.	Price 1s. 2d.
<b>BOOK IV.</b>	220 pages.	Price 1s. 4d.
<b>BOOK V.</b>	264 pages.	Price 1s. 6d.
<b>BOOK VI.</b>	264 pages.	Price 1s. 6d.
<b>BOOK VII.</b>	264 pages.	Price 1s. 6d.

### **THESE READERS CONTAIN**

1. **Interesting Original Lessons** on a great variety of subjects including politeness, health, thrift, cleanliness, duties of citizenship, lives of great men, and stirring events and exploits of recent times.
- Literary Selections** from the best writers in prose and verse, including a very large amount of copyright matter and a number of **Tennyson's Poems**, the whole forming an excellent introduction to English literature.
- Appendixes**, designed to make the reading lessons complete and to encourage careful reading, containing spellings, explanatory notes with sketches, dictation sentences, intelligence questions, composition and grammar exercises.
- Pictures** by the best artists. **Coloured illustrations**, which are neither gaudy nor vulgar, but calculated to educate the colour sense. **Black and White pictures**, which really illustrate the text.

### **A FEW PRESS OPINIONS.**

**The Schoolmaster** says: "The books are suitably graded. The lessons have the charm of freshness. The illustrations are good, especially the coloured pictures. The explanations, given in an appendix, are illustrated, a feature which we much applaud, while paper, type, and binding are just what we expect to find in a first class series."

**The Educational News** says: "These Readers will easily take rank among the foremost in the market. The reading matter has been judiciously selected, and the extracts skillfully edited. The lovely pictures . . . are really admirable."

**The Teacher's Aid** says: "We have nothing but admiration for this most excellent set of Readers. There are certainly no better Readers in the market."

### **SEND FOR BOOK OF SPECIMEN PAGES.**

LONDON: EDWARD ARNOLD, 41 & 43 MADDOX STREET, W.





